PUBLIC HEALTH REPORTS

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U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service

Toward health and stability in Latin America

see overleaf

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The spirit of the cooperative efforts of the United States of America and its sister nations to the south toward health and stability is epitomized in the language of the plaque, shown above, on the wall of the *Serviço Especial de Saúde Pública* hospital at Breves in the Amazon region of Brazil. The inscription under the initials M. E. S. (Ministry of Education and Health) reads:

> *Special Services of Public Health*
> *This building, symbol of the political understanding of good neighbor, was constructed by the governments of the United States of Brazil and of the United States of America*

Over the past 11 years, such expressions of mutual understanding have been repeated many times in many countries of Latin America, commemorating the health activities developed jointly by our own Institute of Inter-American Affairs and the ministries of the other American Republics. Some of these activities were described in *Public Health Reports* for April 1952, pp. 351–357. Beginning on page 829 of this issue, excerpts from the Public Health Service's evaluation, requested by the Institute of Inter-American Affairs, of the first 10 years of these international health undertakings are presented.

frontispiece . . .

In the upper photograph a visiting nurse is making her rounds among the families of La Paz, Bolivia. She was trained by and works for SCISP (*Servicio Cooperative Interamericano de Salud Público*). At left, below, a nurse in a health center at Bogotá, Colombia, advises a mother and children on health maintenance. At right is a typical public fountain installation of a cooperative water supply project at Croix-des-Bouquets, Haiti.

Contents for September, continued

Published concurrently with this issue:

PUBLIC HEALTH MONOGRAPH No. 12 . . . Evaluation of cancer diagnostic tests.

52 pages and illustrations. An interpretive paper and information on availability appear on page 880.

PUBLIC HEALTH MONOGRAPH No. 13 . . . Staffing of State and local health departments, 1951.

Jack C. Haldeman, Bess A. Cheney, and Evelyn Flook.

56 pages and illustrations. A summary and information on availability appear on pages 909–910.

PUBLIC HEALTH REPORTS

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
OVETA CULP HOBBY, *Secretary*

PUBLIC HEALTH SERVICE
LEONARD A. SCHEELE, *Surgeon General*

Servicio

Ten Years of Operation of the Bilateral Health Programs of the Institute of Inter-American Affairs

Excerpts from an evaluation survey
by the Public Health Service, 1953

PUBLIC LAW 369 of the 80th Congress provided that the purposes of the Institute of Inter-American Affairs "are to further the general welfare of, and to strengthen friendship and understanding among, the peoples of the American Republics through collaboration with other governments . . . in planning, initiating, assisting, financing, administering, and executing technical programs and projects, especially in the fields of public health, sanitation, agriculture, and education."

This Congressional enactment in itself recognized the contributions to hemispheric security and well-being which had come from the Institute's activities since its creation in 1942 as a corporate entity under authority granted to the then Coordinator of Inter-American Affairs. During 1952, following upon a suggestion first advanced in 1950 by the Institute, the Public Health Service undertook to evaluate the bilateral health programs which had been developed with our good neighbors during the previous decade.

Public Health Reports publishes in this and succeeding issues excerpts from the findings and conclusions of this survey. The portions have been selected as being of major interest to professional persons in the fields of public health in three respects: first, for their intrinsic factual value as a report of an international technical assistance program; second, as a "case report" of a technical field evaluation of public health practice; and, as a review of current concepts of public health administration.

. . . from the Surgeon General's FOREWORD

The fifth decade of this century witnessed some extraordinary advances in international collaboration in the field of public health. Although these advances were partly due to the urgencies of World War II, they have continued into this decade. There is reason to think that, when the history of these troubled times is finally written, the careful historian will see in the emergence of the cooperative health programs in Latin America a significant development in the Western Hemisphere's search for higher levels of health and stability.

The translation of an underlying cooperative spirit into effective action through a joint administrative device, the *Servicio*, marks a significant experiment in international cooperation in health. A will to work together has been coupled with a way to work together in the family of nations.

Servicio Principle

The *Servicio*, as an administrative device, has stood out as one of the special and characteristic features of the Institute of Inter-American Affairs program. The president of the Institute in 1951 described *Servicio* as:

". . . the generic name of the administrative device through which the Institute works with the other American Republics in the execution of technical assistance or basic economic development programs. The Spanish word "*Servicio*" means service; it is also the synonym for Government bureaus in the United States. A cooperative *Servicio* is a bureau or department of a ministry of a Latin American government, such as the Ministry of Agriculture, Public Health, or Education. . . .

"Although a *Servicio* is part of a ministry, it is autonomous in many respects. Its autonomy is derived from the authority vested in the director to determine, with the concurrence of the minister, the administrative procedure to be followed by the *Servicio*. . . . The Latin American Republic is represented by the minister of the cooperating ministry, and the Institute of Inter-American Affairs is represented by the chief of field party. The Institute sends to the American Republic such technicians as are required and names as the head of the group a chief of field party. The minister and the chief of field party are coequals in developing the administrative techniques to be followed by the *Servicio*."

The Task of Evaluation

To characterize the *Servicio* is one thing. To attempt to trace and evaluate the operation of the *Servicio* in all its multiphasic detail and significance is quite another.

The Public Health Service's report represents an initial step toward tracing and evaluating the operation of the *Servicio* in inter-American cooperative agreements. The study is the first of its kind, and is, therefore, unique. It was a shared project in which the chiefs of field party and the specialists of the evaluation team worked together in the field and later around a conference table in Washington. Their aim throughout, through the process of give and take in frank discussion, was to reach a consensus on the final report. Although time limitations prevented gathering the ideal amount of survey data, the report as a whole gives a picture of the program and sets out some guideposts. Incomplete as the study may be, it can serve as a springboard for further accomplishment in international cooperation for the advancement of health.

LEONARD A. SCHEELE, M.D.

. . . from the IIAA President's INTRODUCTION

During the decade 1942–52 many factors gave impetus to the widespread development of public health throughout the Americas. In light of the importance of public health promotion on a worldwide basis, it seemed important to make some estimate of the values inherent in the joint programs of the Institute of Inter-American Affairs, and to determine somehow, if at all possible, the particular merits of the techniques used and the value and effectiveness of programs focused, as these were, at certain defined areas of health development. It was considered necessary that the facts at least be placed in the open for others to study.

With these ends in view, the Institute determined upon an evaluation of its accomplishments in health, yes, and its failures. It wished this to be as objective as possible. It therefore suggested to the Public Health Service, which has had wide and varied experience in evaluating programs within the United States, that it undertake this task. The Public Health Service agreed to attempt the job and has produced a report unique in character and charged with solid values. The evaluation has been not a dead analysis, but a creative assessment, a guide for the future.

That such an undertaking was impossible of accomplishment on any quantitative, traditional, statistical basis was evident from the fact that the basic data concerning the underlying problems and the progress made toward their solution were lacking. This lack is indeed one of the outstanding problems in Latin America even today. It is one to which too little attention has been paid during the course of the years in the international programs. Further to complicate the problem, the Institute itself did not have basic data with which to measure truly the effect of its individual projects and their impact upon communities. The program from the beginning was an action program which under the exigencies and pressures of war did not allow for the basic studies and the establishment of measuring rods which were known to be desirable. Under war conditions, the indispensable was dispensed with.

The impact upon crude health problems which could be easily seen by the untrained eye could not be measured to the full satisfaction of the technically trained. Many thousands throughout the hemisphere feel, live, and know the deep and truly great values of this program. Recognizing that a cold routine analysis could not be made, it remained, therefore, to determine how an estimate of the accomplishments of the program could be arrived at with the greatest objectivity. It was apparent both to the Public Health Service and to the Institute that an evaluation of the accomplishments of the program would have to be limited to a comparatively quick but nonetheless expert "look-see," one which, while not exhaustive, would carry authority in the world of public health.

C. O. Rowe, Acting President.

The Evaluation Survey

The survey was a joint undertaking of the Public Health Service and the Institute of Inter-American Affairs. Representing the Service until his death in April 1952 was Joseph W. Mountin, M.D., chief of the Bureau of State Services. He was succeeded by J. O. Dean, M.D., associate chief of the Bureau of State Services. Representing the Institute was Henry Van Zile Hyde, M. D., then director of the Division of Health and Sanitation, Institute of Inter-American Affairs, now chief of the Division of International Health, Public Health Service.

The Evaluation Team

Wilton L. Halverson, M.D., director, California Department of Public Health (team director).

John J. Bourke, M.D., executive director of the New York State Joint Hospital Survey and Planning Commission.

Earl V. Bradsher, director of Welfare Administration for New York City and formerly a staff member of the Public Administration Service.

Edna F. Brandt, assistant chief nurse, Division of Chronic Disease and Tuberculosis, Public Health Service.

Mayhew Derryberry, Ph.D., chief of the Division of Public Health Education, Public Health Service.

George M. Foster, Ph.D., visiting professor of anthropology, University of California, and formerly director of the Institute of Social Anthropology, Smithsonian Institution.

Richard F. Poston, officer in charge of Western Gulf and Colorado Drainage Basins Office for Stream Pollution Control, Public Health Service.

George K. Strode, M.D., formerly director of the Division of International Health, Rockefeller Foundation.

The evaluation team was assisted by A. Joan Klebba of the Institute of Inter-American Affairs and Howard Wheeler of the Public Health Service, who contributed to the development of historical data and made extended search and analysis of file material.

Genesis and General Structure

ACTUAL LAUNCHING of the cooperative health program of the Institute of Inter-American Affairs may be said to have occurred with the activation of its first bilateral agreement, that consummated with Ecuador in February 1942.

This inauguration of the program was in effect a projection of one of the decisions reached in the Third Meeting of Ministers of Foreign Affairs of the 21 American Republics, held in Rio de Janeiro in January of the same year. In a resolution unanimously approved, the foreign ministers had recommended the use of the bilateral health agreement as an important instrument for furthering the security and prosperity of the nations of the hemisphere.

Early Activities

Convened against the backdrop of World War II, the Rio de Janeiro conference stands out chiefly by reason of its achievements in line with a mounting concern for a solid hemisphere front in the face of the Axis threat. But, less conspicuously, it was expressive also of a movement which stretched much further back: a slow and more or less sporadic advance in international cooperation in the Western Hemisphere, the beginnings of which had first become apparent in bilateral conventions for control of pestilential epidemics in the first half of the 19th century.

In the wake of these conventions, as the century was drawing to a close, had come the Committee on Sanitary Regulations, created by the First International Conference of American States, in Washington, D. C., in 1889-90. The first half of the 20th century had witnessed the emergence of the world's first international health organization, the Pan American Sanitary Bureau, in 1902; a series of 12 Pan American Sanitary Conferences, beginning in the same year; the signing of the Pan American Sanitary Code of 1924, a provision of which made the Pan American Sanitary Bureau the central coordinating health agency of the 21 subscribing states; and a series of 6 Pan American Conferences of National Directors of Public Health, arranged by the Sanitary Bureau.

The hopes and plans of the farsighted in the field of public health were further translated into concrete measures when the foreign ministers met in Rio de Janeiro at the beginning of 1942. It could have been that the urgencies of defense accelerated an already definite movement. At any rate, the bilateral health agreement was recognized and recommended as a means for closer ties and more effective inter-American cooperation.

In the United States, Nelson A. Rockefeller had long been an outstanding figure in the field of inter-American relations. Even before the Second Meeting of Ministers of Foreign Affairs in Havana, in July 1940, he had sponsored a memorandum to President Franklin D. Roosevelt entitled "Hemisphere Economic Policy." This memorandum was to result in the creation of the Office of the Coordinator of Inter-American Affairs, under which the Institute was later to be established.

Mr. Rockefeller had intimate knowledge of the activities of the international health division of the Rockefeller Foundation. A few years after its establishment in 1913, the Foundation had begun promoting public health, the medical sciences, and the natural sciences in a number of the Latin American republics. Methods employed had included the giving of fellowships, grants-in-aid, and scholarship

grants, and the establishment of special services within the structure of host governments.

The Foundation had placed particular emphasis on the training of nationals in public health and allied fields. Many Latin Americans trained with its aid had risen to influential posts in the health organizations of their countries. They were available to help in forming the nuclei of trained personnel if and when a program of cooperation through bilateral agreements between the United States and its neighbor nations should be launched.

Out of Mr. Rockefeller's experience and first-hand observation, therefore, had come appreciation of the importance of health programs in efforts to attain higher economic levels in the countries of Latin America.

With Pearl Harbor and the subsequent inauguration of the first bilateral program, health in its relation to supply of vital war materials became a matter of immediate and grave concern in measures for defense of the Western Hemisphere. When the Institute became a corporate actuality in March 1942, bilateral health promotion was placed high on the list of major programs.

New Departure

The inauguration in 1942 of the bilateral health programs of the Institute of Inter-American Affairs marked an entirely new departure in United States foreign policy implementation. While evaluation must take into account the emergency conditions under which the programs were launched, it must also consider a purpose extending beyond solution of pressing war-created problems. The record clearly indicates a long-range objective, the attainment of which would mean inter-American cooperation as a permanent contribution to global equilibrium.

The Mechanism

Planning of the bilateral programs had been from the premise that the administrative mechanism of the existing multilateral, national, or private philanthropic organizations could not be adjusted to take care of the new foreign political-technical work seen as necessary for the solution of critical economic, food, and health problems identified as obstacles in the way of attainment of either the immediate or long-range goals. Although the activities of the inter-American system, both governmental and private, had prepared the way for the new programs, it became apparent that a new governmental device would be necessary. Out of this need the program took form.

The mechanism devised had two major parts:

1. A corporation of the United States Government to be known as the Institute of Inter-American Affairs.

2. A unit in one of the ministries of the host government, generally called the *Servicio*, to plan and carry out the projects which would constitute the program in the host country.

These two parts of the mechanism were put and held together by the first interchange of diplomatic notes on the subject of the cooperative program, and by subsequent instruments known as basic agreements between the representative of the Institute and the minister or other designated officer of the cooperating host government.

In the early planning for the health programs, Mr. Rockefeller had made the decision that the administration of health activities should not be carried out directly by the Coordinator of Inter-American Affairs but by a subsidiary corporation. This decision was based in large part on the experience of the international health division of the Rockefeller Foundation, whose years of work had demonstrated the value of placing foreign programs on as flexible a basis as possible without loss of essential administrative control.

The Bilateral Agreements

The Institute's programs were activated from the beginning by agreements entered into with governments of the neighbor nations. After a decision was reached, in consultation with the Department of State, that the establishment of bilateral work was desirable in a given Latin American country, this fact was communicated to the United States Ambassador to that country. After a preliminary authority was given to establish bilateral work, the final authority was usually established through exchange of diplomatic notes between the United States Ambassador and the government of the country selected. This was generally followed by

so-called basic agreements made between the representative of the Institute and the minister of health or a designated officer of an appropriate ministry in the host government. Agreements were in most instances for specific periods of time. At the beginning, 2 or 3 years were usually specified. During the postwar letdown, agreements for only 1 year were made. After 1950, the term was usually 5 years, with funds committed for only 1-year periods.

The Servicio

Under the agreements, both parties provided contributions "in accordance with availability of raw materials, services, and funds," and usually agreed to the establishment of a *Servicio* in the host government.

Before the end of 1942, Dr. George C. Dunham, the first director of the bilateral health work, had supervised the successful establishment of programs in 11 countries. In order of establishment, they were: Ecuador, Haiti, Paraguay, Costa Rica, Nicaragua, Honduras, El Salvador, Peru, Brazil, Guatemala, and Bolivia. In 1943, programs were established in 7 more: Colombia, Panama, Venezuela, Chile, Mexico, Dominican Republic, and Uruguay.

Because of limitation of funds, the programs in Nicaragua, Costa Rica, and the Dominican Republic were terminated in the middle of 1947. The program in Panama was terminated in September 1945. All these programs, except that of the Dominican Republic, were reopened early in 1951.

Table 1. Number and estimated cost of special [1] and cooperative health and environmental sanitation projects in Latin America through June 30, 1951, by class of project

Class of projects	Number	Estimated cost
All projects	1, 665	$103, 015, 915. 56
Special projects [1]	[2] 125	3, 382, 965. 00
Cooperative projects	1, 540	99, 632, 950. 56

[1] Special projects include all projects that were financed directly by the Institute of Inter-American Affairs. These projects did not constitute a part of the country programs that were financed and executed by the *Servicios* in the host countries.

[2] An approximation based on numbering system used for special projects.

Table 2. Number and estimated cost of cooperative health and environmental sanitation projects in Latin America through June 30, 1951, by country

Country	Number	Estimated cost of projects
All countries	1, 540	$99, 632, 950. 56
Bolivia	105	4, 802, 122. 52
Brazil	349	26, 391, 059. 19
Chile	44	9, 082, 780. 21
Colombia	75	8, 961, 382. 04
Costa Rica	43	1, 038, 147. 54
Dominican Republic	24	571, 436. 34
Ecuador	138	6, 860, 722. 44
El Salvador	127	3, 005, 913. 45
Guatemala	38	6, 195, 365. 54
Haiti	89	2, 414, 260. 86
Honduras	69	2, 958, 580. 86
Mexico	125	8, 366, 374. 38
Nicaragua	68	1, 029, 254. 01
Panama	29	684, 608. 97
Paraguay	39	2, 987, 762. 12
Peru	50	5, 872, 413. 00
Uruguay	31	1, 415, 517. 47
Venezuela	97	7, 025, 249. 13

The agreements usually provided that the Institute would send to the cooperating country a small "field party" of professional and technical personnel, including usually a physician, engineer, and nurse. It was also usually provided that the chief of this field party would not only represent the Institute, but would also be the director of the *Servicio* in the host government, subordinate to the minister or other designated officer in the cooperating ministry.

Under the agreements, all work undertaken was to be broken down into projects, and before these were started a project agreement was to be signed by both the chief of the field party as representative of the Institute and by the designated officer of the local cooperating ministry. This arrangement was to encourage joint planning as well as joint financing and execution of all work undertaken.

Personnel Ratios

Servicios were staffed primarily by nationals of the countries with which the Institute was cooperating. The purpose was not only the utilization of nationals, but, through inservice training, to give national professional personnel necessary experience in the maintenance and operation of the projects, all of which by agree-

ment were to be turned over in time to the host country.

As early as February 23, 1943, the estimated ratio of United States to host country technicians in the field programs was 1:25. By the middle of 1945 there were employed 223 United States citizens (including 30 physicians, 52 engineers, 11 architects, and 36 nurses) and 12,278 national personnel (including 356 physicians, 135 engineers, 172 registered nurses, 1,495 other technical and clerical personnel, 1,202 practical nurses or sanitary inspectors, and 8,918 workmen)—a ratio of 1:55.

During the war years most of the United States physicians and sanitary engineers were assigned from the Office of the Surgeon General of the Army. As of June 1952, the number of Latin Americans working on the health programs totaled 7,134 and the number of United States personnel in the field parties and the technical pool, 119—a ratio of 1:60. Included were 462 Latin American and 15 United States physicians and dentists; 298 Latin American and 20 United States graduate nurses; 94 Latin American and 26 United States sanitary engineers; 59 Latin American and 11 United States civil and other engineers; and 40 Latin American and 4 United States health educators.

Program Supervision

The chief of the field party was given very broad authority to carry out the program in terms of projects worked out with the minister of the host country or his designated officer. This was in pursuance of a policy of decentralization and development of local field programs under a system by which all projects for a country would be determined locally by joint agreement.

One of the advantages seen in this policy was that it would operate to allay the expressed fears of "invasion of sovereignty." Some general policy lines were kept in view even in the earliest days, however, by the frequent visits paid to the *Servicios* by Dr. Dunham and other staff members. In 1948 a "technical pool," of always less than 10 persons, was created as an additional arm of the Washington office. The president of the Institute and his immediate staff also made field trips for evaluation of accomplishments. Through analysis of required periodic field reports and of project and completion

Table 3. Number and estimated cost of health and environmental projects carried out by the cooperating host countries in Latin America and the Institute of Inter-American Affairs through June 30, 1951, by category of project

Category of project	Number	Estimated cost of projects	Category of project	Number	Estimated cost of projects
Total	1, 540	$99, 632, 950. 56			
Administration, rent, and equipment of *Servicios*	134	18, 332, 724. 40	Environmental sanitation (water supplies, sewage disposal facilities, markets, slaughterhouses, etc.)	494	$21, 014, 845. 10
Projects to strengthen directly indigenous national and local health services (administration buildings, laboratories, equipment, technical assistance, etc.)	66	3, 398, 922. 07	Health education	19	789, 307. 35
Training facilities and training programs	118	4, 648, 556. 81	Industrial hygiene surveys and studies	2	294, 105. 93
Hospitals, health centers, and other medical facilities and services (construction and operation)	431	36, 744, 967. 57	Nutrition (construction, equipment, and operation)	6	458, 461. 23
Special disease control (including malaria control by drainage)	220	12, 161, 739. 54	Public health statistics	1	566. 21
Medical care programs for highway workers, rubber workers, etc	31	974, 507. 24	Special medical research	2	6, 287. 07
			Social welfare (construction of buildings, playgrounds)	7	90, 349. 89
			School health program	1	5, 723. 18
			Miscellaneous (including matching projects undertaken by Venezuelan Government)	8	711, 886. 97

Table 4. Program funds available to the 18 Servicios in Latin America for cooperative projects from the beginning of the programs until June 30, 1951

Country	Total	Contributed by the host countries [1]	Contributed by Institute of Inter-American Affairs
All countries	$107, 050, 606. 01	$67, 316, 421. 24	$39, 734, 184. 77
Bolivia	4, 852, 112. 52	2, 967, 112. 52	1, 885, 000. 00
Brazil	31, 357, 520. 55	22, 692, 520. 55	8, 665, 000. 00
Chile	9, 208, 430. 05	3, 808, 430. 05	5, 400, 000. 00
Colombia	9, 580, 396. 22	7, 472, 395. 42	2, 108, 000. 80
Costa Rica	1, 199, 257. 86	359, 382. 86	839, 875. 00
Dominican Republic	575, 000. 00	175, 000. 00	400, 000. 00
Ecuador	7, 074, 431. 08	3, 547, 931. 08	3, 526, 500. 00
El Salvador	3, 115, 504. 84	2, 150, 504. 84	965, 000. 00
Guatemala	6, 196, 732. 63	5, 146, 732. 63	1, 050, 000. 00
Haiti	2, 475, 521. 16	1, 387, 521. 16	1, 088, 000. 00
Honduras	2, 989, 710. 72	2, 014, 710. 72	975, 000. 00
Mexico	8, 591, 081. 50	3, 391, 081. 50	5, 200, 000. 00
Nicaragua	1, 119, 582. 37	269, 582. 37	850, 000. 00
Panama	736, 808. 97	175, 000. 00	561, 808. 97
Paraguay	3, 026, 366. 81	1, 376, 366. 81	1, 650, 000. 00
Peru	5, 936, 170. 66	3, 691, 170. 66	2, 245, 000. 00
Uruguay	1, 727, 298. 76	1, 002, 298. 76	725, 000. 00
Venezuela	7, 288, 679. 31	5, 688, 679. 31	1, 600, 000. 00

[1] Includes financial contributions by State and local governments and philanthropists in host countries, but does not include $6,552,171.01 contributed by host government in other than cash (buildings, land, etc.).

agreements on every unit of work undertaken, additional supervision and evaluation of operations were provided for.

Funds

From the creation of the corporation in March 1942, the United States Government financed its role in the bilateral health work by allocation of funds to the Institute. The estimated costs of projects, the amounts of disbursements by the Institute, and the contributions by host governments, from the beginning of the programs through June 30, 1951, are shown in tables 1–4.

The flow of program funds was determined, in the first instance, by the basic and, secondly, by the individual project agreements signed by both the representative of the Institute and the minister of health or other designated officer of the host government.

Although the total figures give some indication of the project patterns in all of the countries, there was considerable variation from country to country. Projects in Ecuador, for example, were primarily in hospital construction in the early part of the program, and later were primarily to augment water supply. Panama's first program was almost exclusively malaria control. During the first year, construction of water supplies was emphasized in Mexico, but later a wide program including health center organization and construction was developed. The reasons for these shifts in emphasis also varied from country to country.

Assessment Viewpoints and Procedures

Problem: How to judge the effectiveness of technical programs in health and sanitation undertaken during a decade of social, economic, and political complexities. The following is a résumé of criteria and methods used in calculating the values of the bilateral efforts of the Western Hemisphere to help good neighbors help themselves.

TWO BROAD AREAS of analysis lay within the problem of evaluating the *Servicio* effort. They were:

Analysis of the health activities sponsored by the cooperating Latin American countries and the Institute of Inter-American Affairs, with special reference to their role in raising standards of living.

Analysis of the Servicio as an administrative mechanism and of its principal operational techniques, with special reference to its role in strengthening indigenous health services.

The overall question to be answered in the first area was: How well did the health activities sponsored by the Institute assist host countries to make the best use of existing health improvement resources, and how soundly planned was the addition of new health resources?

The second area called not only for the collection of information on the variations in the patterns of the *Servicio* and the operational techniques used, but also for analysis of these devices both in relation to their adequacy in carrying out the individual projects and as forces in strengthening and increasing health improvement resources in the host countries.

In any broad judgment of the performance of the men and women whose responsibility was the planning and execution of programs, three factors would have to be considered:

1. No blueprint based on experience existed for the systematic development of health service with foreign financial and technical assistance.

2. The selection of projects was a cooperative undertaking—the Institute and representatives of the host country sharing the responsibility.

3. There had been considerable pressure, because of the exigencies of World War II, to waste no time in getting projects under way and to obtain as obvious results as possible.

Analysis of Health Activities

For the purposes of analysis, health activities could be grouped with little overlapping as: (*a*) auxiliary to military projects; (*b*) auxiliary to individual economic projects; (c) basic health projects.

The problem of evaluating any one of the groups varied considerably from the problems of the others. But for no group was it seen to be the task of the evaluators to measure the value of health activities in relation to balanced economic development programs in the host country. In fact, in no one of the countries included in the survey was it claimed that there existed such a balanced program, with proper weighting given to advancing living conditions and increasing economic production. This is not to say that the Institute had recognized no relation of health activities to the economic systems of the host governments. To the contrary, it was part of the record that health activities, together with those in education, housing, nutrition, transportation, and irriga-

tion, had been regarded as most important for bringing about the progress that must be realized to enable economic development to take place. For a number of years a division of the Office of the Coordinator of Inter-American Affairs, which included the Institute, had been charged with the development of health and allied activities and had been designated as its "basic economy department."

Services Auxiliary to Military Projects

Little time was given to the evaluation of the health services developed in relation to military projects. These had been terminated even before the end of World War II. Of most of them, scarcely any physical vestige remained locally to bear witness to their accomplishments.

Services Auxiliary to Economic Projects

Typical of undertakings to further specific economic activities was the medical care and malaria control work in the railroad construction camps in the Rio Doce Valley in Brazil. This work helped to make possible the relocation and repair of the railroad connecting the rich iron ore region to the coast. Another example was the medical care and environmental sanitation work in the camps established in Central America in connection with work on the Pan American Highway.

The problem of the evaluators was not to weigh the cost of the overhead services in relation to increased productivity in the area, for if it should be found, for example, that development of the iron ore industry was delayed until the railroad should be reconstructed, the fault would lie with the original economic planning or other factors. The health project evaluators could concern themselves only with the technical qualities of the projects and the question of whether immediate objectives were achieved. Again, since most of these projects had long since been completed, reliance had to be placed on the written record and eye-witness testimony.

Basic Health Projects

Basic health projects constituted about 90 percent of all the health projects sponsored by the Institute and the cooperating countries. Adequate evaluation required that they be reviewed (*a*) in relation to the total social development resources and needs of the area they were established to benefit; and (*b*) as to their technical competence and adaptation to media in which they were introduced. The steps required in the analysis were:

Survey of resources, those existing in the countries as well as the funds and technical personnel available from the Institute.

Survey of needs and assignment of priorities to most urgent needs.

Evaluation of allocation of resources to needs.

Survey of Resources

In underdeveloped countries social development resources are always fewer than social needs, just as economic development resources are always fewer than economic needs. A corollary consideration in evaluation is that social needs in underdeveloped countries are always much greater than resources. Yet resources, and not merely needs, must be the basis for judging as well as for planning social development programs.

Among the most important items of information needed in the survey of resources were: national income and its trend over the 10-year period; proportion of government budget allocated to health and medical services; revenue for health and medical activities from other than public sources; existing health and other social facilities and services; capacity and rating of training institutions for physicians, nurses, and engineers; existing professional and auxiliary medical and allied manpower; compulsory and voluntary prepayment medical care plans; private medical and hospital services; income maintenance resources; and public assistance resources.

Survey of Needs

Throughout the 10 years of operation considerably more work had been done concerning needs than concerning resources. Not only the disease situations but the behavior of the general population in relation to healthful living practices could be used as broad indicators of the most urgent needs.

Allocation of Resources to Needs

Evaluation of the allocation of resources to needs was, of course, the most difficult step. The approach could not be based entirely upon the historical experience of those countries which, through several centuries, had evolved more adequate health services. The Latin American countries had not evolved organic services based on strong, long-evolving medical tradition following or paralleling economic expansion. Important health services in Latin America could not be delayed until adequately financed through successful industrialization, but had to be conceived as a necessary overhead or as a mortgage to accelerate economic expansion. Whereas in the more highly developed countries the growth of health services came about from the almost uninterfered-with operation of the law of supply and demand, many of the Latin American countries for several decades had attempted, within their limited resources, to make these services available to those unable to provide for themselves. Moreover, application of the experience of other countries to the problem in Latin America was limited by the fact that there was no broad pattern within which a blueprint could be developed.

Another positive factor limiting the application of the health services found in more highly developed areas was that Latin American countries desired to take shortcuts and make across-the-board use of the great body of technical knowledge that had become available. But, with necessary modifications, the experience of the more highly developed countries could be used for evaluating allocation of limited resources to meet great needs.

It was further recognized that weighing the allocation of resources to needs required consideration of cultural as well as fiscal and technical factors. Cultural factors must include the ways of life, the value standards, and particularly the beliefs and customs of the people with respect to health and illness. Also, the motivation of those nationals whose responsibility was the formation and execution of the health programs in the country must be understood. Without such data, obtained by the application of techniques developed by the social anthropologist and other workers in the social sciences, it would be impossible to determine the major aids and obstacles to accomplishing the objectives of the Institute's health program.

Analysis of the Servicio

Building up health services in a given country with financial and technical assistance from another country immediately introduces a factor that is not present where the development is totally indigenous. This had to be taken into account in the analysis.

Although the same general pattern of operation through a *Servicio* had been recommended to all 18 host countries, in actual operation there had developed about as many patterns as there were *Servicios*. On one hand this wide variation complicated the problem of assessing the *Servicio*, but on the other it increased the experience available for testing the value of different administrative relationships of the *Servicio* to the host governments. It was necessary, therefore, to analyze the effect of the most differing patterns from the following positions: (*a*) relationship of the *Servicio* to the host government; (*b*) relationship of the field party to the *Servicio* and to other parts of the host government; (*c*) organizational structure of the *Servicio;* and (*d*) principal operational devices employed by the *Servicio* in the execution of projects.

Relationship to Host Government

Analysis of the relationship of the *Servicio* to the host government included consideration of whether the position of the *Servicio* was actually that of a unit in the host government or that of merely an intermediary agency recognized by the host government as a subsidiary office of the Institute of Inter-American Affairs.

If the *Servicio* was actually a part of the host government and not merely an intermediary agency, the relationship had to be studied still further to determine if the program of the *Servicio* was coordinated with that of the indigenous health or allied service "on paper" only, or if the *Servicio* actually did function to stimulate and strengthen the growth of the indigenous service in which it was located.

This included consideration of the relationship of the *Servicio* to the head of the ministry or division of the ministry in which it was located.

Field Party Relationships

Examination of the relationship of the North American field party included reviewing the administrative relationship not only of the chief of the field party to the representative of the host government, but of all the technical members of the field party to the nationals with whom they were associated.

It was necessary to know if these technical personnel from the United States served as project directors, heads of functional divisions in the *Servicio*, or as consultants. If they served as consultants, did they serve as consultants to nationals acting as directors of projects executed by the *Servicio* or as consultants to other professional personnel in the structure of the indigenous service? Over the 10-year period had there been changes in the administrative relationship of the North American personnel to the nationals with whom they worked?

It was also important in the evaluation to determine whether the organizational plan of the *Servicio* was primarily for the execution of projects, or whether planning and evaluation was also recognized as a necessary function. This involved examination not only of the organization of both the *Servicio* and the field party, but also of the training and duties of the personnel.

The degree to which the *Servicio* succeeded in strengthening indigenous health services was also influenced by the operational devices employed in executing the individual projects. A possible measure of success in any given field in which continuous effort was exerted would be the rate with which change had been made from execution of projects almost entirely by the *Servicio*, with North American personnel serving as directors of projects, to execution entirely by the appropriate agency of the host government. Steps in between would include, of course, execution of projects by the *Servicio*, with nationals serving as project directors, and execution of projects by units of the indigenous health service other than the *Servicio*, with North American technicians serving as consultants.

Unless the planning and operation of projects are truly the result of teamwork between the North American field party and the host government, the activity may be, on the one hand, an almost direct service by the field party, or, on the other, a grant-in-aid or quasi-grant-in-aid from the United States to the host government.

New Foreign Operations Administration

The Foreign Operations Administration, a new agency in which are centralized foreign assistance and related economic operations formerly dispersed among several agencies, came into being on August 1, 1953, in accordance with provisions of the President's Reorganization Plan No. 7. It is responsible for the administration of the two major related assistance programs previously administered separately by the Mutual Security Agency and the Technical Cooperation Administration, as well as for the performance of other foreign aid and related economic functions formerly carried out by the Director for Mutual Security and the Secretary of State. The names "Mutual Security Agency" and "Office of the Director for Mutual Security" have been abolished.

Use of Anthropological Methods and Data In Planning and Operation

Ways of life and thought patterns of Servicio staff and their clientele are examined by cultural anthropologists. "Knowledge of people," they emphasize, "is as important . . . as medical science." They speak of interpersonal relations, preventive versus curative medicine, the nature of folk medicine in Latin America, and of general cultural factors, pointing to the basic place of cultural facts in planning and operating public health programs.

DEVELOPMENT of successful public health programs depends not only on the technical excellence of medical knowledge and practice, but also on the socioeconomic potential of a country and the readiness of its people to accept new ideas and habits. The economic handicaps under which public health programs in Latin America must operate are obvious; they are a function of the relatively low productivity of these countries and can be ultimately overcome only by a rising standard of living.

Other problems with which public health programs must cope may be called, for want of a better term, cultural problems. These stem in part from the great differences between the ways of life and the thought patterns of the people toward whom *Servicio* programs are directed and the ways and patterns of the planners of such public health programs, and in part from lack of understanding of the factors which make for the most effective human relations in any given situation.

Any meaningful evaluation of the bilateral health programs of the Institute of Inter-American Affairs, therefore, presupposes an understanding of the ways of life, the value standards, and particularly the belief and customs of the Latin American people with respect to health and illness. It means, also, an appreciation of the motivations of both *Servicio* personnel and the peoples toward whom the programs are directed, and their attitudes toward each other. The following summarizes pertinent findings, analyses, and areas of agreement concerning the cultural factors affecting the bilateral health programs.

George M. Foster, Ph.D., formerly director of the Institute of Social Anthropology, Smithsonian Institution, and now visiting professor of anthropology, University of California, was the evaluation team member in direct charge of this section of the report. The following members of the Institute staff carried out the special research summarized here: Charles Erasmus (Colombia and Ecuador), Isabel T. Kelly (Mexico), Kalervo Oberg (Brazil), Ozzie Simmons (Peru and Chile), George M. Foster (El Salvador and Chile). The substantial assistance of Dr. Greta Mostny in Chile is acknowledged.

THE SCIENTIFIC APPROACH

Cultural problems cannot be solved simply by hiring friendly, understanding, well-meaning personnel. The problems must be studied and analyzed with appropriate scientific methods in much the same way a difficult biological problem is subjected to scientific examination.

Recent research in the social sciences has made available both data and techniques which make possible a more efficacious attack on these cultural problems than was possible in 1942 when the Institute of Inter-American Affairs commenced operations.

The present work was carried out by cultural anthropologists. They participated in the survey because they were the social scientists of the United States who had given the most attention to studying Latin American contemporary cultures, to finding out the ways of life in the several countries, and to analyzing the relationship of the individual to his culture. But in any long-range program of cultural analysis other social scientists, particularly sociologists and social psychologists, also should be called upon.

Speaking both from general knowledge and results of *Servicio* studies, the cultural anthropologists summarized their views in these words:

"Knowledge of the people is just as important in many aspects of a public health program as is knowledge of medical science. It is therefore recommended that, in Institute of Inter-American Affairs' program planning, provision be made for systematic research into the form and content of the cultures of each country in which work is carried out. Such research should include anthropological, sociological, psychological, and economic studies. It is further recommended that the information so obtained be utilized in planning and operation of *Servicio* projects, both to determine the economic and social potential of a country which sets absolute limits on the changes which can be brought about, and for the purpose of reducing to the lowest possible level cultural barriers to general acceptance of public health programs."

Dual Role of the Social Scientist

This statement, though general, emphasizes the dual role in which the social scientist was found to be of use: participation in the original planning, and subsequently in the operation of the programs.

The planning role stresses the necessity of finding out the nature of a culture, the way of life of the people, the motivations that make them do the things they do, their goals in life, the objectives they are willing to strive for, and, conversely, the aspects of life that mean very little to them or that they fail to understand. An understanding of the whole cross section of the way of life of the people of a country is almost essential in order to determine limits of any program. What are the people willing and able to accept? What will they reject? What are the social and economic conditions which must exist before certain innovations can be introduced into a culture? If necessary, how can these conditions be brought about?

In the operation of the program, the social scientist's role is that of the educator. After the most practical public health program for a given country or area is determined the people must be convinced that the program really is good for them, that it is in their interest to adopt the new and abandon the old.

Two basic propositions, implicit in the above recommendation, guided the research of the anthropologists:

1. Cultures are integrated functional wholes. Public health programs should be planned and analyzed in relationship to, and as one aspect of, these wholes.

2. There are definite, though imperfectly understood, rules of human behavior which govern the processes whereby changes are brought about in culture. Specifically, popular resistance to public health programs can be scientifically studied, and methods can be developed whereby these resistances can be greatly reduced.

Anthropologists were the first social scientists to formulate the hypothesis that the way of life of a people is an organic, functional, total complex. If the analogy is not carried too far, a culture may be compared to a biological organism in that each of its parts is related in some way to all other parts. Each part fulfills a definite function in relationship to the other parts and contributes to the normal functioning of the body as a whole. Each part, in turn, draws upon all other parts for its own continued existence.

In terms of a public health program, this hypothesis means simply that health and sanitation are not isolated parts of the life of a whole people. They are related to education, social security, economic productivity, distribu-

tion of income, city planning, and a great many other things. Changes in the level of health in any given place may result from changes in the aspects of culture just mentioned; conversely, changes that can be brought about by a given activity are limited by and dependent on the changes that are occurring simultaneously or that can be brought about in these related aspects.

An Exploratory Project

It is possible, the anthropologist believes, to bring about only limited changes in any aspect of culture without accompanying changes in the other aspects of the culture. It is impossible, he believes, to take a very backward country or area and introduce into it a first-class public health program. A specific Institute health program in one of the Latin American countries illustrates this point.

Planning of the program was carried out with great care and thought. There was recognition that a successful public health program depends to a very considerable extent on raising the general economic level of the people. There was recognition that training in home economics and practical farming were integral factors which would contribute to the success of the program. It was decided, therefore, to work in an area where it would be possible to have the cooperation of another agency which was carrying out work in agriculture and home economics. In the small village selected, experimental gardens were set up; training in home economics was introduced; a health post was established, and arrangements were made to bring in a physician and a nurse several times a week to practice both preventive and curative medicine.

Nevertheless, in spite of such planning—excellent as far as it went—certain cultural characteristics of this village became apparent when an overall analysis was made, which raises doubts as to any great degree of permanent success as far as some of the main projects are concerned.

The keystone of the environmental sanitation phase of the work consisted of a privy campaign. Slabs for pit privies were cast locally and given to each of the 100-odd houses in the village. With this preliminary aid, it was expected that within several months most of the slabs would be in place in back yards, the cost of installation borne by the householder. But 6 months later less than half the slabs had been put in use. The majority were still lying against the front of the houses where they had been placed, overgrown with weeds, and nonexistent as far as the householders were concerned. What were possible reasons for this situation?

A census of this village of 600 people was made and the following facts came to light: The village was highly unstable in terms of social organization. About half the inhabitants had lived there for 5 years or less. They did not consider themselves as really permanent members of the community, but rather as migrants who had stopped there while awaiting the opportunity to move on. They felt no attachment to the community, no stake in its future, and they had no interest in making capital investments in something they might not be around to enjoy. A measure of the social disorganization of the village and of the transitory nature of the population was the fact that five professional prostitutes plied their trade, a remarkably large figure in comparison with the average settled Latin American village.

In addition, the land was marginal and wages were low. The least expensive houses in the village were worth from $18 to $35. Instructions for building privies were fairly precise, and the cost was about $10. This meant that people who knew very little about environmental sanitation, who had nothing in their cultural background to make them understand or realize the importance of pit privies, were being asked to make an investment of from 25 to 50 percent of the total value of their homes. It was quite obvious that most of these lower income families could in no way be persuaded to make an investment of this magnitude.

From the census it was also discovered that a considerable number of people in this community lived rent-free in the homes they occupied. The owners were away for extended lengths of time, or they had migrated to other places but had kept their old homes. In order to have their property cared for, they had permitted relatives or friends to occupy the dwellings. Since the actual inhabitants were not the owners and might be put out on a moment's

notice, they were unwilling to spend a relatively enormous sum to build a privy. The owners had little incentive to make such a capital investment since they would not be there to take advantage of it.

Problems of Education

Once it is decided what type of public health project will work in a given place, what is compatible with sociological and economic possibilities, what will have maximum effectiveness in raising general health standards, the problem remains of convincing the people of the need for the project. The planners' ideas as to what is necessary for good health frequently and perhaps usually do not correspond with the felt needs of the people. An important and difficult job of education must be carried out.

The essential problem is this: How is it possible to convince the people that modern medicine and hygienic living are a form of personal health insurance that will keep the individual in better health, make him live longer, and make him able to work more efficiently and enjoy life more fully? How can people who consider much of illness to be due to magical causes or divine will be made to understand scientific concepts of disease and germs, and be made to act accordingly? How can such people be persuaded to take elementary health precautions to avoid disease, to come to the doctor at the first sign of illness, to follow closely the doctor's prescribed treatment, and to avoid the *curandero* (the native medical practitioner) and associated folk remedies?

Fundamentally, the problem is one of persuading people to drop old habits and ideas and to substitute for them new ones which heretofore have been outside their conceptual world. The public health specialist is not operating in a vacuum; his subjects do not feel he is bringing light on a problem about which they know nothing. Rather, he is working in an area in which the subjects already have definite and hard-to-shake beliefs which they are as convinced are correct as he is certain are mistaken. They are not at all sure the doctor's ideas are better than those of the *curandero;* rather, they are often convinced the doctor's ideas are inferior.

Anthropological Techniques

Before attempting to answer some of these questions, the working techniques used by the anthropologists in gathering their data may be noted.

The health center was the focal point of a majority of the analyses. Anthropologists interviewed the directors of these centers, the physicians, nurses, sanitary engineers, sanitarians, and nurse's aides. They sat in the physician's room for as long as 3 hours, observing his techniques with a variety of patients.

Nurses were similarly observed. They were accompanied on visits to the homes; they were studied at BCG-vaccination centers, at "mothers' clubs" where pregnant women were given instruction, and at volunteer workers' training sessions.

Operations of *Servicio* hospitals were also observed. On a random sampling, door-to-door basis, interviewing of populations within the area of health centers was done to obtain a cross section of public opinion with respect to *Servicio* projects.

Health education programs were studied, and limited experimental work in health education was carried out. Tests were given in nursing schools to determine the extent of retention of erroneous folk beliefs among nursing students.

Use was made of the usually rather poor statistical data available.

Informants were "worked" in typical ethnographical fashion to formulate the basic patterns of folk belief concerning health and disease.

The data gathered provided a rather full description of folk medicine in the seven countries studied, including information on the types of illness for which patients will consult doctors and the types which they prefer to take to the *curandero* or treat with home remedies; a good knowledge of health center operations as they impinge upon patients; information on attitudes of patients, potential and former, toward health centers, hospitals, and the medical profession in general; and information on attitudes of physicians, nurses, sanitarians, and other personnel toward their jobs, toward each other, and toward patients, and their ideas of

their problems. Statistical data showing the extent to which *Servicio* programs were patronized were analyzed, as were data on community organization and the possibilities of stimulating better organization as an aid to public health programs. Very significant information on the relationship between curative and preventive medicine, as they bear on public health problems, was obtained.

From the masses of field notes, several general categories of data emerged. Those selected as bearing directly upon the objectives of the survey were (*a*) interpersonal relations; (*b*) relative emphasis on curative and preventive medicine; (*c*) the nature of folk medicine; and (*d*) general cultural factors which impinge upon public health programs.

INTERPERSONAL RELATIONS

In all countries observed it was apparent that genuinely sympathetic relations between the physicians, nurses, and other *Servicio* personnel, and the patients, are essential for smoothly functioning programs. If the interpersonal relations are good, an average or mediocre program, so far as planning is concerned, can be highly successful; conversely, the most brilliantly conceived program amounts to very little if interpersonal relations are poor, if the program is administered in a mechanical manner, if the people who carry it out are not genuinely sympathetic toward the needs and problems of the people they are supposed to be helping. This observation sounds more like a truism than the result of scientific analysis; it is made because, obvious as it may be, many *Servicio* programs are falling short of their potential because of poor interpersonal relations between staff members and patients.

How can good interpersonal relations be achieved? This is a complex problem which admits of no easy solution. In part, it is due to the rather rigid concepts of class and caste which prevail in Latin American countries, with culturally determined modes of contact between different classes. In part, it is due to a lack of education of the masses, and to innate fear and suspicion of members of one group toward members of others. The solution will begin to come as these social barriers are broken down.

Public Health Nurses

There is one key to the problem, however, which holds out great hope for the immediate future. Without exception, the anthropologists were impressed with the importance of the role of the trained public health nurse, the university graduate. In Mexico, in El Salvador, in Ecuador, in Chile, in every country from which information was available, a most important factor making for the success of a public health program was seen to be the availability of graduate public health nurses. Even when the attitude of the physicians is cold and unfriendly, good public health nurses can do much to establish good relations between the health center and the patients.

In a *Servicio* center in a large capital city, for example, some physicians observed were very unfeeling. Nevertheless, a competent group of public health nurses had succeeded in establishing themselves as friends of the people. When the nurses made home visits, children often saw them at a distance and ran with the news to their mothers, who greeted the nurses at the door with a smile and warm reception. Mothers regarded the nurses as real friends, not just as nurses, and as their buffers against the cold formality of the center itself.

Naturally, there are great differences between nurses who have had identical training. Nevertheless, the great majority of Latin American public health nurses who are graduates of good schools are excellent in their interpersonal relations with patients.

The Need for Nursing Schools

Although *visitadoras* (nurse's aides), often with as little as 4 years of basic education, were not observed to the same extent as were the nurses, it was felt that they functioned far less successfully. Often they knew little more than the people they were trying to help; they were timid, unsure of themselves, lacking in basic education, and unable to inspire much confidence. Faith in their ability on the part of professional personnel generally was low,

nurses saying that they must be closely watched all the time, and physicians saying that their turnover was high because of low salaries and because after learning a little they would go into business as *inyeccionistas* (dispensers of hypodermic injections).

The anthropologists felt that every reasonable effort should be made to stimulate the development of more nursing schools, that perhaps even more emphasis should be placed on this aspect of Institute activities than in the past. A question has been raised as to whether *visitadoras* should be eliminated entirely, but practical necessity dictates their continued use. If greater attention is given to the educational and cultural background of future *visitadoras*, and if their training is planned accordingly, it is probable that their effectiveness can be considerably increased. In Brazil, for example, good use appears to be made of them. But *visitadoras* can never be more than a poor substitute for well-trained nurses.

PREVENTIVE vs. CURATIVE MEDICINE

The problem of good interpersonal relations between *Servicio* staff members and patients is linked with the question of curative versus preventive medicine. When the initial studies were made in Mexico, Colombia, Peru, and Brazil, significant differences in the quality of the interpersonal relations were noted. To illustrate, it appeared that there was a closer understanding between staff members and patients in Brazil than in Peru. The first hypothesis advanced to explain this situation was rooted in the problem of class structure. In the Latin American countries which have a comparatively large Indian population, it was observed that educated city people tended to look upon the less fortunate, and particularly the Indian groups, as beings from another world incapable of being assimilated as useful members of national life. At first glance it seemed as if in those countries where these conditions prevailed the quality of interpersonal relations was generally poor.

Following subsequent work in El Salvador, Ecuador, and Chile, it became apparent that this tentative formulation did not hold. In Ecuador the social gulfs are about as marked as in any American country; yet the physicians and nurses appeared generally to get along well with the patients. Tensions and frictions seemed much less prevalent than in Colombia, where the socioeconomic level was much higher and class differences were less pronounced. The tentative hypothesis of anthropologists—and it should be tested further—is that in those countries where there is frank recognition that for a long time to come curative medicine must be an integral part of any public health program, relations between staff members and the public are good. Conversely, where curative functions are grudgingly accepted by the *Servicio* authorities or avoided entirely, interpersonal relations are poor, and public health programs are much less successful.

Whatever the merits of a public health program based on preventive medicine, the fact remains that the average Latin American is interested in physicians and nurses because they can cure his ills. He usually avails himself of *Servicio* services not primarily to keep well, but to get well.

A survey of 100 families was made in the area of the Beatriz Velasco Aleman Center in Mexico City to find out who patronized the center, and why. Half of the people interviewed had never been to the center. Of the approximately 50 families that had gone, 25 went because they had a sick child that needed attention; 12 went because they could get free milk; and a number of others went because they needed chest X-rays or other clinical services. Only 3 or 4 gave as their main reason for attending the clinic their desire for a routine checkup of an infant. Conversely, one of the principal reasons why mothers had not taken their children was the fact that they were well—"why should one take well children to see a doctor?"

Popular Concepts of Health

This reluctance to seek or accept medical advice when apparently well is deep-rooted in Latin American concepts of well-being. Health, it is thought, consists in feeling well; it is not possible to be ill if one feels well and has no evident symptoms of disease. Since

sickness is due to sins of omission or commission, or to fate or luck, there is very little a well person can or ought to do to keep himself well, at least as far as a physician's attentions are concerned. Treatment is sought only when a person becomes ill.

This feeling about health, which is all too common with the uninformed, is akin to the concept of machinery maintenance: If a machine runs well, obviously it is in good condition and needs no attention; it is logical to repair it only when it breaks down. Periodic checkups have no logical reason or explanation in the minds of people with this point of view. They feel they are doing the center a great favor in keeping appointments, rather than that they are being helped. There seems to be no stimulus sufficiently strong to keep well people coming to health centers, unless certain concessions toward what the people believe they need are made.

Persuasion by Demonstration

Moreover, there is a deep-seated distrust of the motives and knowledge of physicians in much of Latin America. Many people feel that the native *curandero* knows more than a physician, and everyone can and loves to tell of situations in which the physician failed and the *curandero* effected a cure. At the same time, the average Latin American is pragmatic by nature. One of the reasons, therefore, why *Servicio* programs should stress curative medicine is that it is about the only way the physician can show the patient that he knows what he is doing.

To illustrate, in Temuco, Chile, a bad whooping cough epidemic occurred in 1951. Fortunately, health authorities were in a position to vaccinate a large number of children and to arrest the spread of the epidemic. There is no doubt in the minds of most mothers in that town that the physician is a good man to know when whooping cough threatens. And this faith has spread to other inoculations as well; BCG vaccinations are being carried out with a high degree of cooperation from all.

A similar case was noted in Quito, Ecuador. As in much of Latin America, the people in this city believe that fresh air is dangerous, particularly for new mothers. Many complaints against the new *Servicio* maternity hospital were believed to stem from the fact that there is too much fresh air. But even more people remarked, "Fresh air is dangerous, but there is plenty of it at the *Maternidad* and it seems to harm no one, so maybe after all it isn't dangerous." Similarly, new mothers are sent home after a stay of about 5 days, whereas the culture pattern dictates that the mother should remain in bed as long as 2 weeks. There were criticisms of this short stay, but again the remark was heard that the *Maternidad* mothers had more and better babies, with no apparent harm to mother or child, so perhaps the physicians knew what they were doing. Thus, educational work, essential to any public health program, was being carried on in a forceful manner.

The satisfaction of the patient in receiving a public health service which he or she wants and the satisfaction of the physician and nurse in offering a service a patient desires seem to have promoted an atmosphere in which suspicion and tension have been reduced to a minimum, and in which, as a consequence, really good preventive measures can be effected. In the Cerro Barón Center, Valparaiso, Chile, where curative medicine is recognized as just as important as preventive medicine and where no sick child is ever turned away, more than half of the visits are "well baby" visits. By meeting the felt needs of the people—helping them when they are ill—the physicians and nurses have been able to persuade a sizeable portion of the people that it is a good idea to take preventive measures even though an individual is perfectly healthy.

If the premise is accepted that in the long run better world health will result from preventive medicine, the fact must also be recognized that a sizable amount of curative services must be available to develop the conditions essential for a preventive program.

NATURE OF FOLK MEDICINE

If *Servicio* personnel were better acquainted with prevailing concepts and practices of folk medicine, many opportunities would occur for contributing to the overall effectiveness of pro-

grams. Although in Latin America there is no single integrated theory of disease, there are certain common themes and patterns which are so general as to form a framework within which local variations can be studied. These ideas of health and illness are the end result of a long period of fusion of two currents of thought: the American Indian concept of the universe and man's place in it, and the ancient medical heritage brought to the New World by the Spaniards.

Heritage of Hippocrates

Probably the largest single element in the Latin American beliefs is that which has come down through two milleniums from the humoral doctrine of Hippocrates and Galen. Health resulted, according to that theory, when the four humors—blood, phlegm, yellow bile, and black bile—were in proper proportions in the body. These four humors, which corresponded to what were believed to be the four elements of the universe—fire, air, earth, and water—were characterized by opposing qualities of heat, cold, dryness, and moistness. This doctrine, with subsequent modifications and elaborations, reached Spain and Western Europe via the Arab world and was transmitted to Hispanic America, where it remained the basis of medical classification and teaching until the 18th century. Selected aspects of this theory—particularly the concept of heat and cold as qualities of the body, of types of illnesses, and of foods and herbs—became part of the folk belief of most peoples. General concepts of "humors" have also prevailed.

Hence, there has come to be a widespread tendency to explain much illness in terms of "heat" or "cold," qualities which do not necessarily indicate actual temperatures, but which are innate attributes of substances. Pneumonia, for example, is often classified as a "cold" disease, whereas typhoid fever may be a "hot" disease. Foods, as well as herbs and other remedies, are also frequently classified as "hot" or "cold." In Xochimilco, Mexico, for example, some of the "hot" foods are sugar, honey, green chile pepper, brandy, black coffee, human milk, garlic, peanuts, onions, and salt. "Cold" foods are rice, spaghetti, potatoes, most meats, beans, most leafy vegetables, most fruits, coffee with milk, and chocolate. A concomitant belief is that "hot" illnesses should be treated with "cold" medicaments and foods, and vice versa. Although there is no universal agreement as to which foods or diseases are "hot" and which are "cold," this concept of illness exists in most parts of Latin America.

The "hot" and "cold" distinction provides a scheme for defining under what conditions certain foods can be eaten, what the results will be if the scheme is violated, which remedies can be used for which illnesses, and what the results will be if these rules are transgressed. In short, it appears that "hot" and "cold" distinction provides a general framework of do's and don'ts for much of popular medicine in Latin America.

The "Clean Stomach" Belief

A second common belief is that periodic cleansing of the stomach and intestinal tract by means of strong physics is essential to health. The common Latin American practice of taking a physic every 3 or 4 months is rooted in this concept. The belief seems to be associated with the idea that the liver is a chief source of illness, and that purification of the blood is essential to recovery from illness or maintenance of health. The relatively high proportion of digestive upsets among persons questioned suggests the reason for preoccupation with the stomach, and also explains the extraordinary number of herbal remedies which "wash the stomach clean." Preoccupation with the blood is exhibited in the general belief that extraction of blood for venereal disease or other tests weakens the patient, and explains why in some communities health authorities making periodic checkups of children have been run out of town by irate parents.

Causative Beliefs

In each country or area studied, folk medicine was found to have a core of principal illnesses, none of which has an exact equivalent in modern medicine. Each illness has a recognized cause or causes, symptoms, and cure, and can be described in the same way the medical practitioner describes the etiologies, syndromes,

and cures of the diseases recognized by modern science.

Some "folk" causes may be said to be "rational," in that they are explained on the basis of the body of empirical knowledge to which the group has access. The knowledge may be erroneous in terms of modern science, but it makes sense in terms of the logical premises of the group. For example, the widespread belief that experiencing abnormal cold is the cause of respiratory illness is "rational."

Closely related to extreme cold as a causative agent is *aire* or *mal aire* ("air," "bad air"), when this is explained as an actual current of air which cools the body, producing various types of illnesses. Contracting *aire* is almost inevitable if one emerges from a house when warm, or if one breathes air much colder than what one has just been breathing. From these beliefs stems the Latin American idea that central heating is unhygienic if not actually dangerous. The violations of "hot" and "cold" food prohibitions, when such violations lead to illness, may also be classified among the "rational" causes.

The role attributed to "microbes," however poorly the term is understood, is another evidence of a rational pattern. For example, the recognizably contagious qualities of such diseases as measles and smallpox make them fall in this category. The belief that gonorrhea comes from intercourse with a menstruating woman or from sitting on a hot rock, that malaria comes from eating certain fruits or not sleeping enough at night, and that "bad odors" cause illness, as well as the Chilean concept of *empacho*, likewise are "rational." The latter is one of the most common folk ailments afflicting children and is believed to be caused by an object such as green fruit, soft bread, or half-cooked food becoming stuck in the stomach or intestines.

"Natural" Causes

In general, illness and injury which are explained as due to such "rational" or empirically determined causes are considered by the folk to be "natural." The most common "natural" diseases have names which correspond to those of modern medicine, and in terms of popular syndromes and sometimes etiologies, but rarely cures, they are essentially the same. They include whooping cough, colds, grippe, appendicitis, diphtheria, measles, chickenpox, smallpox, intestinal worms, diarrhea, venereal disease, typhoid fever, pneumonia, and tuberculosis.

"Magical" Causes

Other causes may be said to be magical or supernatural in form, in that they lie outside the body of empirical knowledge of the group and are not verifiable or understandable in terms of that knowledge. *Mal de ojo* or *el ojo* ("evil eye") is the most widespread "illness" in Latin America which is explained in magical terms. Certain individuals are believed to have the power, often unintentional and sometimes unknown to themselves, of causing illness in small children by looking at, touching, or admiring them.

Sometimes *susto* ("fright") is magical in origin, in that a malignant spirit or ghost may take possession of an individual or be the cause of the fright. Bewitchment, which involves sticking pins into, or otherwise injuring, rag dolls or images representing a victim, is not uncommon. The belief that a corpse emanates a cold essence which can cause bystanders to fall ill, unless ceremonial bathing or cleansing follow, is another example of a supernaturally produced condition. In El Salvador this emanation is *hijillo*, and in Colombia *hielo de muerto*. *Mal aire*, when the malevolent air is due to evil spirits, is a supernatural happening, as are *entuertos* (postpartum pains caused by contraction of the uterus), widely believed to result when the placenta is not disposed of in ritual fashion.

Psychological Causes

Folk recognition that strong emotional experiences can cause an individual to fall ill is evidenced by the wide variety of sicknesses that are essentially psychosomatic. Those emotional experiences which most often produce physiological results include fright, anger, desire, imagined rejection, embarrassment or shame, disillusion, and sadness. *Susto* or *espanto* results from fright, and, frequently, it is explained as a shock which separates the spirit from the body. The cure depends on inducing the spirit to return to its temporal home.

Colerina is the term often used for disturbances produced by great anger or rage; in Mexico epilepsy is thought to be due to this experience.

Desires are called *antojos;* unfulfilled food desires of pregnant women may result in birthmarks, whereas those of small children will cause the child to suffer gastric upsets. In Chile, the wise parent, consequently, never denies a child any food, drink, or sweet it wants, however inappropriate it may be. In most countries sibling rivalry is recognized, often in a form in which a child shows unconscious resentment toward an unborn child of its mother. In Mexico this jealousy is known as *sipe*, in El Salvador the child experiencing this feeling *está peche;* in Ecuador *pasión* results; in Peru the term is *caisa*, and in Chile it is *pensión* (anxiety). In Peru embarrassment or shame produces *chucaque*, and in El Salvador it causes a bothersome sty known as pispelo. The Peruvian *tiricia* is the result of a strong disillusion, and the Ecuadorian *mal de corazón* results from the loss of a loved one, loss of money or property, or some similar saddening experience.

"Popular" Curative Techniques

Folk cures make use of a variety of techniques, the most common of which is the drinking of herb teas. Massage is often resorted to, and it is usually explained as an action that removes the illness or poison from the body. The famous egg-rubbing of the body of a child believed to suffer from the evil eye falls in this category. A warm, freshly laid egg is passed over the body of the patient, then broken open and examined; if a spot appears on the yolk it is assumed that *el ojo* has struck the child. This diagnostic practice is also believed to have therapeutic value.

Poultices are often used, sometimes for mechanical effects but more commonly for magical reasons: in Peru and Colombia a live pigeon is split open and applied to the body for certain illnesses. Diet, with special attention to the "hot" or "cold" qualities of the foods, is of importance in all places. Certain days and certain hours of the day are often used for curing. Religious orations and creeds frequently are recited.

Medical Practitioners

Folk medical practitioners are most commonly called *curanderos* (feminine, *curanderas*), though other terms are encountered. Midwives are called variously *parteras*, *comadronas*, or *curiosas*. Usually these men and women occupy their positions after long periods of formal or informal training, not infrequently as apprentices or assistants to older practitioners. Only rarely do they have divine or supernatural powers to aid in their cures. Sometimes they may use "black magic," but this also is relatively rare. In general, they are honest, sincere practitioners and respected members of the community. Beyond doubt, they frequently cure sickness and alleviate suffering; their knowledge of herbs, as well as of psychology, must be very considerable. In most cases they cannot be looked upon as witch doctors or as frauds or shams.

A Prevalent Dichotomy

A more or less pronounced dichotomy exists in the minds of many Latin Americans between "folk" illnesses and those recognized by medical science. People know that certain types of disease, which do not respond to treatment by *curanderos*, can be cured or prevented by the physician. At the same time they feel that there are other illnesses that are best treated by home remedies or *curanderos*—illnesses which are not understood by physicians, and the very presence of which is denied by physicians. These illnesses are generally those here referred to as "folk" diseases, particularly those described as having magical or psychological etiologies. If an illness is diagnosed, for example, as evil eye, obviously it is poor judgment to take the patient for treatment to a person who denies the existence of the disease. To illustrate, in Valparaiso, Chile, a public health nurse visited a home and found a child suffering from bronchial pneumonia. She asked why the child had not been brought to the health center for treatment and was told, "The child is suffering from evil eye, and you know as well as I that the doctor does not know anything about the evil eye."

This dichotomy is not hard and fast; there

is no sharp line in the minds of all persons between the two categories. Yet the common tendency on the part of physicians and nurses to ignore or ridicule folk concepts of illness undoubtedly at times reduces their effectiveness in that this attitude reinforces the dichotomy. As a result, many genuinely sick persons do not receive proper medical treatment. Although there is a growing awaremess of microbes in Latin America, there is a marked tendency to understand by "microbes" those things that cause the illnesses that physicians can cure. Microbes have nothing to do with the *el ojo*, *susto*, and the like.

Several attempts were made to measure the extent of the practical effect of this dichotomy between "folk" and "doctor's" diseases. In Quito, Ecuador, a list of the most common complaints was given to 48 school children of both sexes, ages 11 and 12 years, and they were asked to indicate which illnesses they would take to a doctor and which they would treat with home remedies or take to a *curandero*. It was assumed that the opinions expressed would correspond closely with those which they had heard from parents and other adults. Results are shown in the accompanying table.

In Chile a similar test was made, and similar results were found; the evil eye, *aire*, *empacho*, and *pasmo* (facial paralysis thought to result from exposure to air) were universally agreed upon as being unknown to doctors. Individuals suffering from these diseases would therefore receive home treatment, often gravely prejudicing their chances of recovery since the symptoms are often symptoms of serious illnesses. Anemia, appendicitis, hernia, meningitis, pneumonia, smallpox, typhoid, and the like, generally (but not invariably) were thought best treated by doctors. Results of a survey in Colombia also were similar. Illnesses with magical or psychological etiologies tended to receive home treatment or that of the *curandero*, whereas those due to "natural" causes were more likely to be taken to doctors.

Percentage of 48 school children in Quito, Ecuador, who would consult a doctor or a curandero for specified illnesses

Illness	Would consult a *curandero* or treat with home remedies (percent)	Would consult a doctor (percent)
Fright [1]	98	2
Air [1]	93	7
Witchcraft [1]	86	14
Colic	79	21
Evil eye [1]	75	25
Stomatitis	72	28
Pasmo [1]	66	34
Open infections	66	34
Urinary complaints	64	36
Skin disorders	61	39
Diarrhea and vomiting	58	42
Emaciation	49	51
Smallpox	31	69
Dysentery with blood	25	75
Pneumonia	25	75
Whooping cough	20	80
Liver complaints	16	84
Paralysis	9	91
Typhoid	7	93
Bronchitis	6	94
Malaria	5	95
Tuberculosis	4	96

[1] Diseases with magical or psychological etiologies.

The Physician and the Curandero

The conflict between folk medicine and scientific medicine is summed up in the persons of the physician and *curandero*. Each represents the highest achievement in his field. The attitudes of the people of Latin America toward each, therefore, are pertinent to this study. Unfortunately, the physician frequently comes off second best. This is due in part to the inherent nature of the situation, and in part to native suspicion of individuals in other social classes, particularly those above them.

The *curandero* operates under conditions that are relatively more favorable than those of the physician, from the point of view of impressing the patient with concrete results and apparent success. He treats folk illnesses, the symptoms of which often are so ill-defined that he cannot help but succeed in alleviating them. If the vague physiological symptoms identified with the illness persist or reappear after the cure, the *curandero* can always say that the case has become complicated and requires another series of cures or a different cure, or that a new and different illness has attacked the patient. Also, most *curanderos* do not claim to cure all illnesses, and in many cases can even recom-

mend that a patient consult a physician. These factors establish the *curanderos* in the minds of the folk as fair, open-minded individuals willing to admit their limitations. Finally, the *curandero's* diagnostic techniques do not require elaborate and exhaustive questioning of the patient as to symptoms, case history, and the like. He has certain magical or automatic devices which he applies to specific situations, and the answers follow almost like clockwork. Moreover, there are many cases reported by field observers in which a physician failed to cure an individual and a *curandero* had apparently genuine success.

The physician enjoys few of these advantages. His diagnosis is seldom cut and dried, he cannot guarantee quick results, and he seldom enjoys the faith and confidence accorded the *curandero* because he is from a social class instinctively distrusted by the majority of his patients. Moreover, the physician seldom admits that a *curandero* can cure things which he is incapable of treating, and this is interpreted as meaning that he conceitedly and selfishly believes himself to be the sole repository of medical knowledge—a point of view which the village is loath to accept.

Criticisms of physicians and their professional methods are rife among the patients of the lower class, and such criticisms are usually based on a complete lack of comprehension of medicine, its methods, and its limitations. Several patients pointed out that physicians asked them questions about their symptoms, which showed that the physicians were not as smart as they thought they were. A good *curandero* doesn't have to ask questions, so why should a man who pretends to know a great deal more have to do so? Another patient scornfully pointed out that a president of Colombia died "even though he had 50 physicians at his bedside." The implication was that if 50 physicians could not keep a man from dying, a single doctor in a short interview was almost worse than worthless.

A final handicap of the physician is the general tendency of the people to exhaust home remedies and the arts of the *curandero* before appealing to the physician. The physician, therefore, gets many cases too late to effect a cure and many others which are simply incurable. Hence, the failures of folk medicine as well as those of his own profession are heaped upon his shoulders.

Utility of Cultural Knowledge

If the people in Latin America could come to believe that the physicians and nurses understand the folk beliefs concerning health and sickness and approve of some of the folk remedies (for example, isolation, bathing, specialized diet, and herbal teas), but that they simply feel that for many things they have even better methods, it is very likely that the people would evince greater tolerance for modern medicine. There must be great numbers of people who would like to follow a physician's recommendations but are afraid to do so because of folk tradition or because of doubts arising from the feeling that the physicians do not know about some types of sickness.

The utility of knowledge of folk concepts of illness and treatment has been demonstrated. In Chile, as in the other countries, herbal teas form an important part of the *curandero's* pharmacopoeia, and popular confidence in them is great. For infant diarrhea some *Servicio* physicians therefore prescribe, in addition to other remedies, herbal teas. Drinking quantities of liquid is part of the treatment for diarrhea; by the device of teas it is possible to insure boiled, and therefore safe, water. Thus, by interpreting treatment in terms of local belief, the physicians have convinced the mothers that they know what they are talking about, and at the same time, have assured proper treatment of the child.

In Ecuador—and most of the rest of Latin America—it is believed that young children are "delicate," that they are more susceptible to danger from witchcraft, microbes, and other disease-causing agents than adults. A water supply system was installed by the *Servicio* in Tulcan. Adults showed little interest for themselves in a source of pure water—they had been drinking contaminated water all their lives, with no apparent ill effects—but they recognized that their children were more vulnerable than they. By placing the emphasis for the need for pure water upon the health of the children, rather than on health in the abstract, greater interest was aroused.

In Colombia, *malos olores* (bad odors) are popularly believed to cause disease. Typhoid fever particularly is described as a disease associated with bad smells. For this reason, considerable opposition to pit privies exists in some places. Greater attention to means of deodorizing pit privies might very well result in their greater acceptance. Conversely, knowledge of this belief ought to provide a strong focal point to gain support for sanitation campaigns, particularly modern sewage- and garbage-disposal plans.

In Mexico, isolation of patients is a part of the treatment of some illnesses. In most cases isolation stems from the belief that the patient is in a weakened condition and that visitors knowingly or unknowingly might further injure him, particularly through the evil effects of *aire*, of strong body "humors," or of "strong" blood. There is little thought that a patient is coughing germs which may infect others in the family. But, whatever the folk reasoning, an essentially hygienic practice is followed, one that can be successfully utilized by physicians and nurses in the treatment of communicable diseases. The nurse need not remark on the potential danger of *aire;* she can simply say that visitors are undesirable, and the family will probably follow her recommendation, even though she is thinking in terms of contagion and they in terms of magic.

GENERAL CULTURAL FACTORS

More general aspects of Latin American culture patterns bearing upon the Institute's public health programs were also covered in the evaluation. Mexico furnished a striking example. A survey had shown that in a large urban health center 43 percent of registered women discontinued prenatal treatment before delivery, the majority failing to return to the center after the first gynecologic examination. In a nearby semirural health center only 21 percent discontinued treatment. Allowing for some variation because an urban population is less stable than a rural one, there was nevertheless a significant difference between the percentages for the two centers.

The explanation seemed to be based on Mexican (and Latin American) ideas of decorum and modesty. The first prenatal examination comes as a great shock to most women. The examination itself is embarrassing, and is doubly so when it is made by a man. In the rural health center the women were carefully prepared for the experience. The nurse explained just what would be done, why it must be done, that it probably would be done only once during the course of treatment, and that she (the nurse) would be present all the time. In the large center the patients were given little idea of what to expect.

In another center, in Colombia, there was practically no gynecologic examination. The women refused to submit to it, partly because of their own feelings, and partly because their husbands were outraged at the idea of any other man having such intimate contact with their wives.

Even in Chile, where health services were generally well advanced, it was noted in a large health center that the gynecologic examination, such as it was, was done by a midwife, the physician hardly looking at the patient beyond taking her pulse and listening to her chest. On the other hand, in a small center in El Salvador where women were well prepared by the nurse, there was little embarrassment shown during examinations, and relatively few of the women failed to return for further treatment.

The impersonality of modern medicine runs into a cultural barrier of considerable importance in Latin America: Prevailing concepts of modesty are incompatible with the requirements of medical treatment. At the very least, a thorough and sympathetic explanation appears to be necessary to make gynecologic examinations generally acceptable.

Physician-Patient Communication

Cultural factors pose serious barriers to full development of public health programs in other ways, too. In all countries studied the problem of communication between physicians and patients existed. A significant number of patients, after seeing the physician, did not know what they had been told to do.

In the Cerro Barón Center in Valparaiso, Chile, one of the finest in Latin America, 13

women were asked as they emerged from the physician's room to repeat his instructions. The remarks of 10 indicated that they had failed to profit from the visit. Similar results were found in the other countries. In the Cerro Barón Center, and in some other centers, this problem was partially solved by having the physician write the instructions on the patient's record card. Before leaving the center, the patient would visit the nurse, who would repeat from the card the instructions and explain in greater detail what the patient was supposed to do.

Failure to comprehend the physician's instructions was due to a variety of reasons. Often, a woman patient would be nervous and uneasy in the presence of a man, particularly since she usually was in a lower social class than he; she would therefore be unable to concentrate or to grasp what was being said.

Development of greater rapport between physicians and patients will partially solve this problem. But it must be realized that the manner in which instructions are phrased is also highly important. What appears simple and logical to an educated person may not be at all simple to a less well educated, often illiterate, individual. In the United States, it is taken for granted that patients will understand what is meant by such instructions as "every 3 hours." Yet in much of Latin America this expression is meaningless.

In a Mexican center, for example, the physician told a mother to nurse her baby "every 3 hours." The anthropologist asked the mother at what hours she would feed the child. "At six, seven, eight, and so on," replied the mother. The startled physician repeated his instructions, and the anthropologist again asked the mother when she was supposed to feed the child. The answer was the same. Instructions in terms of time as defined by hours simply were meaningless to this woman.

When significant numbers of a center's patients come from illiterate and low-income groups, groups which are not used to clocks, it would seem wise to work out adaptations of the time concept in terms of phenomena which would have meaning to the people. In most cities, there are factory whistles, municipal sirens, church bells, and the like, which sound at regular hours. Time points with meaning for each area could be established, and instructions might be phrased in such terms.

A similar case of misunderstanding was noted in Temueo, Chile, where pregnant women were told by the physician to walk 3 kilometers a day if they felt well. At a meeting at which volunteer nurse's aides were being trained, the nurse asked, "How much exercise should a pregnant woman take every day?" All trainees promptly replied, "Walk 3 kilometers daily if you feel well." The anthropologist asked, "How far is 3 kilometers?" This precipitated a lively discussion. Some women thought that the cipher "9," and others that 27 blocks, was a part of the formula. The women were unable to agree as to how far 3 kilometers is in terms of blocks. As in the case of time instructions, these instructions were of no use whatsoever to the audience toward which they were directed because the people were not trained to think in the same terms as the physician.

Hours of Work

Bureaucratic hours and practices were found to constitute a considerable cultural barrier to full acceptance of some *Servicio* projects. In much of Latin America, government hours are from 8 a. m. to 2 p. m., or a similar time period. Allowing time for opening and closing the office the effective hours are considerably reduced. Moreover, since full-time physicians are the exception rather than the rule, many physicians are at the health centers only an hour or two a day and have considerable latitude with respect to arrival time.

To be reasonably sure of attention, then, a patient must come early in the morning and await her turn. For a busy housewife, with many small children to get off to school, morning marketing chores to do and a husband coming home at noon to eat, the loss of half a day was found to be an almost insurmountable difficulty. Loss of time was the single most frequent complaint from health center patients. If some services could be rescheduled for the afternoon (as is actually done in a few centers), it is very likely that more patients would be attracted and that their attitude toward the center would be more favorable. In El Salvador, the semiprivate

Botón Azul, which offers prenatal service from 7 p. m. to 9 p. m., is an obvious success, as its crowded waiting room attests.

The Privy Problem

The humble pit privy may also be used to illustrate the importance of understanding the general cultural configurations of a country. Privy campaigns probably have been carried out in all Latin American countries. Public acceptance in some instances has been good, but all too often privies have been used as chicken coops or as grain silos. Customary posture in defecating is perhaps the single most important fact which bears on the acceptance or rejection of privies.

A coffee planter in El Salvador, for example, built a series of privies, one for each house on his plantation, according to the standard American "riser" model. He was upset when his employees refused to use them. Finally an old man offered the suggestion, "Patrón, don't you realize that here we are squatters?" The planter ripped out the seats, replaced them with a perforated slab floor, and was gratified to find that public acceptance was general.

In La Dorado, Colombia, *Servicio*-built privies appeared to meet all cultural specifications, but were not well accepted. The anthropologist found that an important factor was the belief that bad odors in themselves are carriers of infection and causes of illness. Many people felt they were observing good hygiene in not using privies.

BASIC CULTURAL FACTS

Since greatly increased attention is being given to cultural factors in the planning and operation of public health programs, some of the general theoretical implications of the work done by the anthropologists who participated in the survey may be mentioned. Foremost among these is the question of how much an administrator must know about a given culture in order to carry out a specific project. Ideally, the more he knows about the cultural milieu in which he operates or proposes to operate, the more successful he will be.

It is axiomatic with anthropologists that culture is an integrated, functional whole, in which the separate parts continually impinge upon each other, conditioning and governing, and in turn being conditioned and governed. A change in one part of a culture will produce secondary and tertiary disturbances in other parts, or the primary change may be difficult to induce because of limiting circumstances surrounding adjacent areas of culture.

In Latin America, the success of public health programs is to a very considerable extent dependent on corresponding advances and modifications in a number of other aspects of the culture. These embrace technological devices, systems of social and political organization, and attitudes and values. Bodily hygiene, for example, is more than a question of education and persuasion. It implies the presence of pure water in reasonable quantities—a system of piped water in most instances. But a modern water distribution system requires a maintenance organization, tools and replacement parts, power for pumps, and a sociopolitical structure to administer the system, collect bills, and provide personnel. Improved bodily hygiene, therefore, requires new mechanized devices, new technical knowledge, new attitudes, and new systems of cooperation. The individual who operates on the assumption that a superior idea or technique alone will attract supporters, regardless of the cultural context into which it is introduced, will encounter many frustrating experiences.

Primary Social Data

Although it is desirable to know as much about a culture as possible, there are obviously strict limitations as to what can be known. Social scientists have barely made a beginning in the formidable task of describing the elements of the cultures of the world and interpreting their significance. It must be assumed that for any given program there are certain categories of information about the culture in which the work is to be carried out which are of primary importance, and others that are of lesser importance. A "trial run" in compiling a list of primary classes of data for public health programs gives the following picture.

The points mentioned are suggestive and illustrative and do not pretend to be a definitive catalog.

Folk medicine and native curing practices. The significance of these data has been discussed.

Economics, particularly incomes and costs of living. The cited case of failure to build privies because of their relatively high cost indicates the importance of this aspect of the culture. Inability to pay for medicine is one reason why many persons fail to avail themselves of treatment at the health center. The possibility of achieving a balanced diet is also restricted by inability to pay. Inadequate housing is a great problem in many parts of Latin America. Since in the final analysis the success of public health programs rests upon major changes in the habits of people with respect to diet, housing, clothing, agriculture, and the like, knowledge of the economic potential of an area is paramount.

Social organization of families. In Xochimilco, Mexico, for example, a bride often lives in her husband's home, under the domination of her mother-in-law. A number of cases were noted in which pregnant women failed to follow, or had difficulty in following, health center recommendations because these conflicted with what the mother-in-law thought was best.

Men and women who live together are frequently not legally married. Under such circumstances, a man is less likely to recognize obligations to his companion and their children, and it is therefore more difficult to persuade him to come to the health center for venereal or other treatment. Recognition of these and similar problems makes the responses of patients more intelligible.

Education and literacy. Ability to comprehend the real nature of health and disease, to profit by health education, and to understand and follow the physician's instructions depends on the education and literacy of the people.

Political organization. Local conditions under which physicians and other staff members are appointed, bureaucratic rules which govern operations, and the like, are factors which will affect public health programs. In one country, for example, a large health center, not yet placed in operation, was seriously threatened by the conflicting interests of the state governor, the local nurses' union, and other bureaucratic factors.

Religion. A basic analysis of religious tenets is not essential, but some parts of the religious philosophy of the people should be known. Are there any beliefs which hinder or directly conflict with proposed programs? Is death, for example, at any age considered a welcome relief from a world of suffering? Are there food taboos based on religious sanction which should be taken into consideration in planning diets?

Basic value system. What are the goals, aspirations, fundamental values, and major cultural premises, consciously or unconsciously accepted, which give validity to the lives of the people in question? What is the practical significance, for example, of a fatalistic approach to life and death? What part does prestige play in determining customary behavior patterns of the people? Is male vanity and ego a factor to consider? What are the ideas of bodily modesty? What are the types of stimuli and appeal to which people respond most readily?

Other types of data. Planners and administrators of public health programs should also have at hand such information as credit facilities and money usages, labor division within the family, time utilization, working and eating schedules, cooking and dietary practices, and the importance of alcoholism.

Categories of culture in which precise knowledge would appear to be of lesser importance include agriculture, fishing, and other primary productive occupations, industrial techniques (except as working conditions may affect health), trade and commerce, religious fiestas and church observances, wedding ceremonies, burial customs, and music and folk tales.

Use of Social Science Data

Specific health programs should be projected against basic data, decisions made as to what specialized additional information is needed, and plans made to gather such information.

For some parts of the world, considerable quantities of these basic or "core" data are available. Latin America is such an area. The

anthropologists who made this analysis were working in a field in which a great deal of preliminary, pertinent work had been done. Anthropologists, and to a lesser extent sociologists, have for more than 20 years been quietly gathering, analyzing, and publishing data on Latin American cultures. Much of this work was done with no thought of immediate practical application. Neverthless, it represents a large stock of accumulated scientific "capital," much of the value of which lies in the fact that it is generalized and not specialized, and therefore affords a workable background for the institution of a wide variety of programs.

The discovery, classification, and interpretation of new facts merely points the way to continuing research. Simultaneously, however, this process makes possible the solution of technical problems of steadily increasing complexity and variety, and consequently of expanding utility in the practical or applied context.

Therefore, one of the best uses of the social sciences in the bilateral health programs of the Institute of Inter-American Affairs is the direct assignment to field parties of individuals well versed in the most recent developments in their fields, both to do generalized cultural research and to gather specialized information to facilitate specific projects. Such a plan would make it possible for administrators and program planners to have a continually growing body of precise factual information which, judiciously utilized, would eliminate much of the guesswork which otherwise cannot be avoided.

CIRCULARIZATION

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Polluted Air, a Growing Community Problem

By HENRY N. DOYLE

Can we achieve that to which every citizen is entitled: an atmosphere of reasonable cleanliness? This review of some of the constructive efforts which communities in the United States are making to study and control the ever-increasing problems of air pollution gives hope that we can learn to manage the great sewer that is the atmosphere.

AIR POLLUTION, the most complex problem facing the environmental hygienist, has been with us ever since man began to use coal as fuel. As technology advances, the problem becomes more acute. In the past, the hygienist hesitated to tackle it because he lacked the necessary equipment to measure the effects on man or to measure the microquantities of contaminants in the atmosphere. Nor was there any general demand for action since the public had customarily associated industrial stack discharge with prosperity.

In recent years, however, the 1948 smog disaster in Donora, Pa., and the growing significance of the Los Angeles air pollution problem have changed the public's attitude from apathy to anxiety. Some measure of this change has been evident in the requests the Public Health Service receives for information on air pollution, a negligible number prior to 1940. Each year sees a significant increase in their volume. In addition, during the past 5 years, 25 cities have requested investigations similar to the one made in Donora by the Public Health Service.

Industry, as well as government, is keenly aware of the growing interest of the public in atmospheric pollution and its health and economic implications. Many millions of dollars are being spent by both for research and correction. Industry itself is spending an estimated $120 million a year to control air pollution. Even so, few experts believe that in the foreseeable future our cities will have "country fresh" air. Air pollution is a penalty of our modern way of life, and, unless we wish to pay exorbitant prices for certain commodities, we may have to tolerate a certain degree of atmospheric pollution for years to come.

The public in general fails to realize that the atmosphere is the world's greatest sewer. All organic waste, industrial or otherwise, must finally be discharged into the air either directly, through combustion, or by disintegration. Technology, however, in many cases can alter the chemical composition of industrial and domestic organic compounds so as to make them innocuous. In the past, we have used the atmosphere to disperse much of our inorganic waste over large areas. This type of pollution can be prevented with modern dust collection systems and electrical precipitators. Such control measures are costly, however, and they can-

Mr. Doyle, an industrial hygiene engineer, has been chief of the State aid branch, Division of Occupational Health, Bureau of State Services, Public Health Service since July 1952. This article is based on a paper he delivered in College Station, Tex., at the 1953 Short School sponsored by the Texas Water and Sewage Works Association on March 10.

not be expected to be put in general use in the absence of either restrictions or economic advantages.

The effects of atmospheric pollution on people may be arbitrarily divided into four major categories: effects on human health and comfort, toxic effects on animals and vegetation, economic damage, and loss of natural resources.

Health Effects

The effect on health of chemical air pollution has been a controversial subject ever since the use of coal was banned in England during the thirteenth century because of the alleged injurious effects of coal smoke. Current scientific literature is replete with allegations concerning the harmful effects of chemical air pollution. Investigators have attempted to correlate an increasing incidence of respiratory and chronic diseases and an ever-rising rate of lung cancer with the increased severity of pollution. However, in many cases the investigator has been able only to implicate air pollution because of other corresponding and determining factors such as housing, income, nutritional status, and intelligence levels.

A study of the possible relationship of smoke to increased mortality is now under way in England in connection with the recent record fog. Following the 4 days, December 5 to 9, 1952, in which the greater part of metropolitan London was continuously enveloped by a smoke-laden fog, a spectacular rise in deaths occurred.

During this period, abnormally large numbers of persons of all ages died from causes associated with respiratory difficulty. This was similar to what had happened immediately after a comparable fog in 1873, but the death rate in 1952 was much greater and was, in fact, as great as that during the worst week of the last cholera epidemic. Exceptionally high concentrations of smoke and sulfur dioxide were recorded. The highest average concentration was 4.46 mg. of smoke per cubic meter of air and 1.339 parts of sulfur dioxide per million parts of air (*1*).

Although there are no large metropolitan areas in the United States which suffer extended periods of smoke-laden fogs, significant smogs do occur in certain industrial areas. Largely because of the enormous difficulties in obtaining reliable data, epidemiological investigations have not been made in these communities. The field of the chronic effects of smog on health thus remains relatively unexplored. Nonetheless, despite the absence of any clear-cut etiology, it is difficult to ignore the vast mass of indirect evidence on chronic effects.

The acute effects of air pollution have been easier to substantiate. Conclusive proof has been afforded by three recorded episodes in which large masses of people were affected. These involved the Meuse Valley, Belgium (*2*), Donora, Pa. (*3*), and Poza Rica, Mexico (*4*). In the Meuse Valley (1930), 60 persons died and several thousands were made ill. In Donora (1948), 20 persons died and some 5,000 were affected in varying degrees. In neither case was the causative agent specifically identified. Most authorities agreed that a combination of contaminants was responsible. A large concentration of industry in a narrow valley and the occurrence of unfavorable weather conditions were circumstances common to both episodes.

The Poza Rica incident (1950), in which 22 persons were killed and 320 were hospitalized, was due to the accidental release of hydrogen sulfide to the atmosphere, which resulted from the failure of mechanical equipment in a sulfur recovery plant. This incident, however, should be classed as an accident since similar possibilities exist wherever large volumes of toxic gases are being processed or transported.

Other isolated incidents affecting numbers of people have also been reported. In one small industrial city, a beryllium manufacturing plant had since 1943 been discharging into the community atmosphere certain beryllium particulates that by 1951 gave rise to 16 cases of chronic beryllium poisoning. Five of the persons so affected have died. Because of the radial distribution of the cases, the source of the poisoning was unmistakably traced to the beryllium plant (*5*).

To our knowledge, such occurrences are rare. When detected they can be controlled through education, or, in the instance of a recalcitrant industry, by means of local law. Unfortunately, however, health authorities do not always have complete information regarding

the location of plants manufacturing or processing dangerous and toxic chemicals.

In contrast to infrequent acute health effects, sensory discomforts are well recognized by all persons who have had any contact with air pollution in major metropolitan centers. Obnoxious contaminants include those substances which irritate the eyes or nasal passages and those which have a distinct and often irritating odor. The atmosphere in Los Angeles has been particularly affected by lachrymators which cause frequent sensory disturbances. Although these materials have never been proved to be injurious to health, they certainly do not contribute to a sense of well-being.

Toxic Effects

While some of the alleged chronic effects of air pollution on human beings may be difficult to prove conclusively, there is unmistakable evidence that pollutants influence the growth and development of animals and plants. Animals have become sick from eating vegetation which has been contaminated with fluorides from the stack discharges of certain industrial plants. As a result, the teeth of grazing animals in fluorine-polluted districts have been known to deteriorate so much that the animals were unable to feed. Advanced fluorosis in these animals has been associated with such symptoms as lameness resulting from bone lesions, reduced feed consumption, emaciation, diarrhea, decrease in production, and lowered breeding efficiency (*6*).

The Public Health Service's investigation of the Donora smog incident, which was characterized by a combination of pollutants, revealed that an appreciable number of domestic animals became ill, and some died. Dogs appeared to be the most susceptible, both as to morbidity and mortality.

Air contaminants may also harm plant life. They may discolor crops and reduce yield. Acid gases in the atmosphere may scorch leaves and young plants beyond recovery and may sour the soil. In some industrial areas, there are no crops, gardens, or vegetation because of the harmful effects of air pollutants.

Sulfur dioxide from smelting and other industrial operations adjacent to forest regions has had a pronounced detrimental effect on tree growth. Continued absorption of atmospheric sulfur dioxide has been known to reduce conifers, which normally maintain their needles for 3 years or longer, to only the current year's growth of needles. Other important atmospheric contaminants which can cause injury to vegetation include hydrogen fluoride, sulfuric acid aerosols, and certain unidentified organic compounds.

Economic Damage

Annual direct losses from air pollution in the United States are estimated as amounting to at least $1.5 billion, or about $10 per capita (*7*). A large part of this loss obviously is caused by damage to or destruction of vegetation. In 1950, for example, approximately $300,000 worth of leafy vegetable crops alone were damaged by smog in the Los Angeles area (*8*). Contributing to the total expense is damage to property, including the discoloration and disfiguration of buildings. Corrosive acid gases in the atmosphere eat away stone, mortar, and metals. It has been reported that sheets of galvanized iron had a life span of 3–6 years in Pittsburgh as compared with 7–14 years in a smoke-free community and that copper would last only 10–20 years in Pittsburgh, whereas it would last indefinitely where there is relatively little atmospheric pollution.

The interiors of buildings are also subject to soiling and corrosive action on walls, rugs, draperies, linens, and clothes. Replacements must be made frequently. Soap, laundry, and dry cleaning bills are increased, adding to the household living costs. The Mellon Institute of Industrial Research estimated that in 1913 over $2 million was spent in Pittsburgh on extra laundry and dry cleaning of clothing soiled by soot; another $75 million was spent on cleaning and renewal of wallpaper and curtains.

There is a loss of merchandise in stores. Polluted atmospheres also cut down the normal amount of sunlight. More artificial lighting is needed, thus increasing the cost of illumination. Air contaminants may even force people to move to another community, thus causing a drop in real estate values.

Loss of Natural Resources

A further loss by air pollution lies in the large tonnage of valuable materials emitted into the atmosphere. The Mellon Institute estimated that in 1926 about 160,000 tons of nitrogen were lost in smoke from soft coal used in American households. This amount was equal to nearly half the inorganic nitrogen used that year in the United States. Although this nitrogen would not be recoverable, it serves to illustrate the magnitude of losses by industrial processes.

According to the United States Bureau of Mines, 700,000 tons of manganese, representing approximately 50 percent of our yearly requirements of this critical commodity, could be recovered annually from processing losses. Among the rare metals, germanium, gallium, rhenium, and selenium are being lost in flue dusts and smelter discharges; recovery processes are yet to be developed. Great Britain is reported to be dissipating yearly in coal ash 1,000 tons of gallium and 2,000 tons of germanium into the air (*9*).

The economic value of reclaiming substances previously discharged into the atmosphere may be illustrated by the experience of the Canadian smelter which formerly caused crop damage in the State of Washington. The smelter now uses its sulfur dioxide in the manufacture of fertilizer. As a result, the returns to the smelter from this operation exceed the value of its smelting operations.

Major Studies

Until relatively recently, measurements of the degree of air pollution consisted of fall-out studies in which concentrations were expressed as tons per square mile of surface. Such studies were helpful in demonstrating that, in many highly industrialized areas, the dust-fall amounts to hundreds of tons per square mile per year. This system of measurement, however, failed to identify the contaminant and gave no index of the diurnal variation. Consequently, it had critical shortcomings as an aid to effective abatement and control of air pollution. With recent progress in instrument development, the chemist is now able to evaluate both quantitatively and qualitatively the atmospheric particulate matter and certain of the gases. Concentrated research, though, remains to be done on the isolation and identification of certain materials, particularly the hydrocarbons and other organic compounds, which exist in the atmosphere in trace amounts.

Table 1. Concentration of metallic elements in urban atmospheres in micrograms per cubic meter of air

Element	Average values		
	Detroit	Windsor	Charleston
Silicon	3.5	6.4	8.7
Aluminum	3.2	3.0	2.3
Iron	3.0	2.8	.8
Calcium	2.5	7.8	1.4
Magnesium	.6	.9	.4
Lead	.4	.7	.2
Zinc	.4	.3	Absent
Manganese	.2	.3	.13
Copper	.05	.4	.11
Titanium	.05	.1	.01
Tin	.04	.06	.01
Molybdenum	.03	.05	.01
Barium	.01	.07	.03
Cadmium	.01	.006	.002
Chromium	.008	.02	Trace
Nickel	.006	.03	Trace
Antimony	.005	Absent	Absent
Vanadium	.002	.009	Trace
Cobalt	.001	Trace	Absent
Beryllium	.001	.002	.001

A number of studies of various air pollutants have been made in major industrial areas. Table 1 shows an analysis of the metallic constituents of the atmosphere in three cities: Detroit, Windsor (Ontario), and Charleston, W. Va. (*10*). In each instance, the same methods of sampling and spectrographic analysis were used. It is evident that certain elements such as iron, calcium, magnesium, and silicon constitute the bulk of the metallic elements (80 to 90 percent). It will be seen in table 1 that the elements below manganese generally occur in amounts less than 0.1 microgram per cubic meter. In comparison with the predominant metals, those of lower concentrations—manganese and below—are commonly considered the more toxic. This uniformity of findings, if substantiated by further study, is of great importance in that it indicates a common problem in large and diversified industrial areas.

An interesting comparison of the area distribution of certain elements in Detroit and

Cincinnati is shown in table 2. As might be expected, there is an increase in the total particulate atmospheric load as one moves from the residential section to the center of the industrial area (*11*). Organic matter constitutes the major portion of air contaminants, since the metallic elements comprise only from 5 to 11 percent of the total weight. According to some authorities, the bulk of the organic matter is considered to be gasoline combustion products, organic chlorides, ketones, aldehydes, and organic acids.

Table 3 illustrates the concentration of some organic constituents found in the Los Angeles area (*8*). Insufficient work has been done to determine whether or not a common pattern of organic constituents exists in other areas.

In an air pollution study conducted in Salt Lake City in 1951, the contaminants were collected by electrostatic precipitation rather than by filtration, were accumulated for the duration of the study, and were chemically analyzed. Table 4 illustrates the inorganic constituents according to their relative proportions. Here again is evidenced the same general order of the metallic elements as was found in Detroit and Charleston. The only exception is silicon, which, in this case, dropped from 1st to 6th place. Despite the fact that Salt Lake City is a nonferrous smelting center, the order of the metallic elements is almost identical to that for the Detroit area where the industries are primarily ferrous in nature.

The accumulated material from the Salt Lake City study was split into benzene soluble and insoluble fractions. The benzene soluble and combustible fraction constituted 22 percent of the sample and was assumed to consist of tars and hydrocarbons; the benzene insoluble and combustible fraction (48 percent of the sample) was assumed to be soot and insoluble tars. The difference (30 percent of the sample) was ash or inorganic matter. Comparable data on the organic fractions for other areas are not available. Photomicrographs of the particulate matter collected during the Salt Lake City smog of November 28, 1950, are shown in figure 1.

Weather conditions greatly affect the concentration of atmospheric contaminants. In the Cincinnati study (*11*), it was found that the concentration of the particulate matter was greater in the winter months by a ratio of almost 2 to 1; whereas the number of particles present in the atmosphere increased by a ratio of almost 4 to 1. As is evident in table 3, the degree of contamination by the gaseous material in Los Angeles is much greater on days of reduced visibility than on days of good visibility. The same observation may be made for the particulate matter. For instance, the concentration of all the contaminants, except formaldehyde, shown in table 3 increased by a factor between 5 and 6; the formaldehyde concentration was only doubled. Other studies done in Los Angeles have proved that days of

Table 2. Concentration of certain elemental constituents in the atmosphere of Detroit and Cincinnati, according to district

Element	Average values in micrograms per cubic meter of air					
	Residential		Semi-industrial		Industrial	
	Detroit	Cincinnati	Detroit	Cincinnati	Detroit	Cincinnati
Iron	3.0	6.0	5.4	7.7	7.4	12.7
Aluminum	3.8	2.2	4.6	4.0	5.0	5.3
Silicon	2.6	----------	3.7	----------	4.1	17.7
Calcium	4.3	----------	4.3	----------	3.6	5.2
Lead	.6	1.0	1.0	2.0	.9	3.7
Zinc	.2	1.6	.4	1.3	.7	2.0
Manganese	.18	.2	.23	.4	.3	.4
Copper	.11	2.0	.13	.8	.2	1.2
Tin	.03	.1	.04	.1	.04	.1
Total concentration of all pollutants	184	191	279	344	381	472

Table 3. Concentration of pollutants in the Los Angeles atmosphere; maximum values as measured over downtown Los Angeles on various days

Pollutant	Concentrations (in ppm) by volume	
	Day of good visibility	Day of reduced visibility
Acrolein	(1)	Present
Lower aldehydes	0.07	0.4
Carbon monoxide	3.5	23.0
Formaldehyde	.04	.09
Hydrocarbons	.2	1.1
Oxidant	.1	.5
Oxides of nitrogen	.08	.4
Ozone	.06	.3
Sulfur dioxide	.05	.3

[1] No quantitative method is known for measuring low concentrations of acrolein.

reduced visibility correspond with certain meteorologic conditions, especially temperature inversions.

Figure 2 illustrates the effect of inversions on the intensity of the Salt Lake City smog. On February 8, 1951 the atmosphere was thermally normal or unstable whereas on February 15, an inversion existed, resulting in atmospheric stability. On both days the wet bulb temperature and wind velocity and direction were of the same order of magnitude. Relative humidity was 55 percent on February 8 and 80 percent on February 15.

From the foregoing, several conclusions may be drawn:

The atmosphere is a great receiver and diluter of civilization's waste products.

It is suspected that there is a relationship between air pollution and certain chronic illnesses in humans although this has never been definitely proved. There is no doubt, however, that under certain combined topographic and meteorologic conditions, acute illness and death in man may occur.

Certain atmospheric pollutants when present in sufficient concentration have definite toxic effects on animals and vegetation.

Atmospheric pollution causes great economic waste and a loss of valuable mineral resources.

There appears to be a remarkable similarity in the qualitative pattern of the inorganic pollutants in large industrial areas which have climatic and industrial resemblances.

Contaminants are largely organic in nature, but insufficient information is available on the organic constituents to conclude that there is a similarity in the organic contaminants in industrial areas.

The degree of pollution in any area is affected by seasonal and meteorologic variations.

Governmental Activities

There is no legislation governing air pollution on the Federal level although several bills have been introduced into Congress to give Federal agencies, chiefly the Bureau of Mines and the Public Health Service, authority to engage in certain research aspects of the problem. Major Federal activity in the field of air pollution in recent years has been confined to a comprehensive investigation of the Donora disaster by the Public Health Service. Currently, at the request of the International Joint Commission of the United States and Canada, a study transcending international borders is being conducted in the Detroit-Windsor area by the Public Health Service and the Canadian Government (*12*).

At present, almost every State and local in-

Table 4. Metallic elements in Salt Lake City smog

Element	Percent of total sample
Aluminum	2.5
Calcium	2.0
Iron	2.0
Magnesium	1.0
Lead	.7
Silicon	.4
Copper	.4
Zinc	.2
Manganese	.1
Tin	.06
Titanium	.04
Molybdenum	.03
Nickel	.02
Chromium	.01
Antimony	.01
Arsenic	.01
Barium	.01
Cobalt	.01
Vanadium	.01

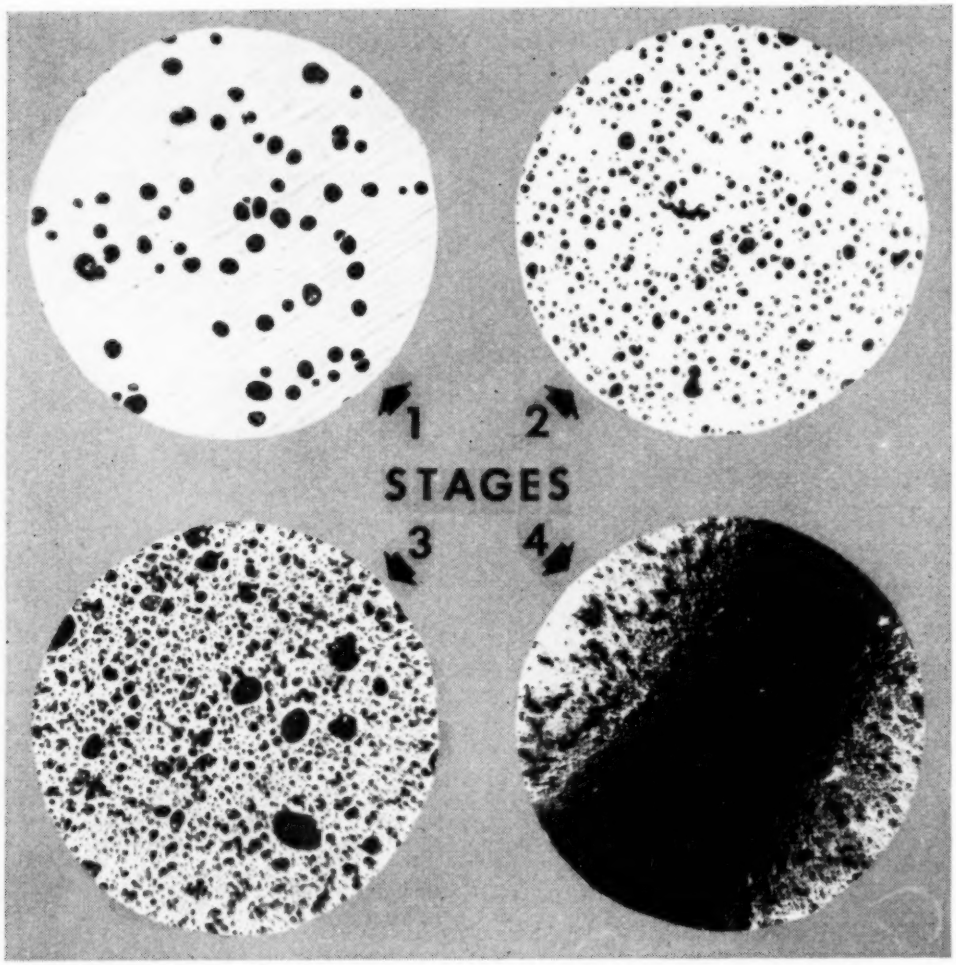

Figure 1. Photomicrographs (magnification 100×) show the particulate matter collected by a cascade impactor in the fall of 1950 during a Salt Lake City smog. The impactor separates and collects atmospheric particles according to size. Stage 1 shows the larger particles. Stages 2 and 3 show the intermediate size particles—the larger ones visible are probably due to impaction and coalescence. Stage 4 shows the smaller particles.

dustrial hygiene agency is engaged to some extent in air pollution studies. Industrial hygiene agencies are well qualified for such activities because of their experience and knowledge in dealing with a wide range of airborne contaminants. In many instances, they have had to assume this responsibility at the expense of their regular activities.

Pennsylvania is among the States with a full-scale air pollution program. Since early in 1949, when the Pennsylvania General Assembly authorized funds for the study of the problem, an air pollution unit has been operating within the bureau of industrial hygiene of the Pennsylvania Department of Health. The staff studies technical phases of air pollution problems, conducts investigations wherever necessary, and assists communities in the evaluation of local problems. The air pollution unit is fully equipped with testing apparatus and meteorologic equipment and has a mobile laboratory and apparatus for the determination of atmospheric sulfur dioxide concentrations.

In Maryland, air pollution control constitutes an important activity in the divisions of industrial hygiene of the State Department of Public Health and the Baltimore City Health Department. While specific air pollution legislation

has not been passed, the State legislature has appropriated moneys for this work for the past 3 years. Activities of the State unit have generally been confined to investigating local problems created by specific industries. To facilitate its work, the State has available a mobile laboratory and testing equipment. Requests for assistance with air pollution problems have been particularly numerous in Baltimore. During the 1952–53 fiscal year, 70 percent of the 230 complaints received by the Baltimore industrial hygiene unit dealt with community air pollution.

In New Jersey, too, the bureau of adult and industrial health devotes much of its time to air pollution problems. The bureau not only investigates complaints, but also engages in research on methods of sampling. At the same time, it is attempting to bring about a better understanding of the problem by the general public. The bureau is presently conducting a study of the highly industrialized Perth Amboy area. This study is an excellent example of how a State can plan and initiate an air pollution study and maintain the confidence and support of both the public and industry.

The West Virginia division of industrial hygiene recently completed a study in the Greater Kanawha Valley industrial area, which was requested by an industry and citizens' advisory committee, and industrial groups contributed $25,000 to help defray a large part of the cost. The Kettering Laboratory and Institute of Industrial Health assisted in the technical study, and the Public Health Service gave consultant services. The study clearly defined a need for continuing studies and for a long-range plan based on technical principles that would enable the best control possible within the limits of sound economy. The report also emphasized a need for uniform, accurate, and continuing records of emissions to the atmosphere by industry.

The Oregon Legislature in 1951 established an Air Pollution Authority as a part of the State health department. The authority is directed to investigate the extent and magnitude of air pollution in the State and to develop a comprehensive program for the prevention and control of all sources of air pollution.

Air pollution activities are more prevalent on the local level. Many large cities, including Los Angeles, New York, Cleveland, Detroit, and St. Louis, have recognized that smoke control is but one aspect of the air pollution problem and, in addition to previously existing smoke abatement units, have established air pollution control units. Most of these city units are policing agencies, which base their actions on sound technical studies and reasonable standards.

The activities reviewed above are but a few examples of the air pollution work being conducted by various States and municipalities. They are intended only to depict the diversity of activities and illustrate different methods of approach.

Various private agencies have also been active in the field of air pollution. Particularly noteworthy is the fine work being done by the Kettering Laboratory and Institute, the Battelle Memorial Institute, the Industrial Hygiene Foundation, the Lake Carriers' Association, the Manufacturing Chemists' Association, and many universities as well as numerous other organizations. We look to these agencies to develop better equipment for air pollution control and to bring about a better understanding of the problem on the part of industry and the public.

The Job Ahead

Air pollution is not an insolvable problem. However, its solution is going to require patience, persistence, research, and a mutual understanding among the public, government, and industry. Each can and must play a definite part in bringing about cleaner air for our towns, cities, and metropolitan areas.

The public must realize that it is a part of a modern technologic society and that its continued high standards of living call for full industrial production. The average man must further realize that he too is a contributor to air pollution because of his automobile, his backyard incinerator, and often, because his home heating system is inefficient. The impact of chemical air pollution on our health and resources has been manifested for only a relatively short period. Given sufficient time, the problem can and will be solved. It is not meant to imply, however, that in the meantime a citizen should stand idly by and possibly have his

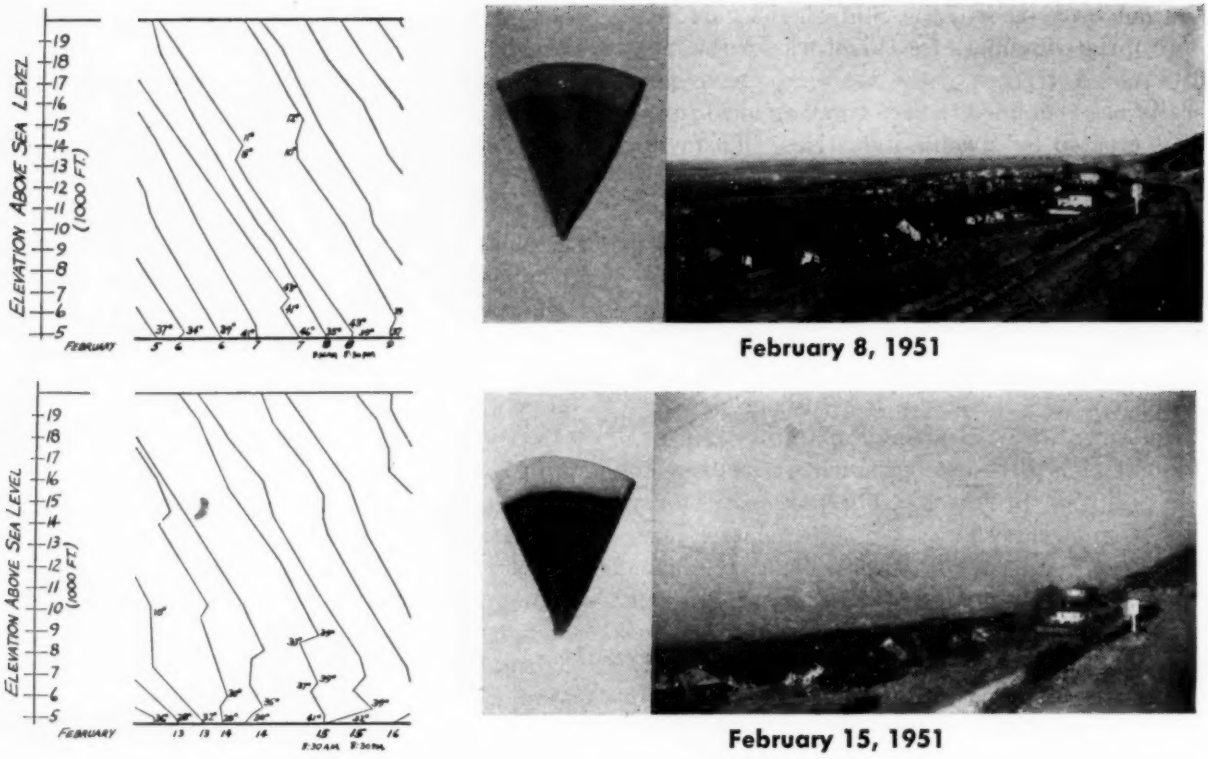

Figure 2. Illustrations of effect of inversion on smog intensity in Salt Lake City, February 8 (top row) and February 15 (lower row). The graphs show aerological soundings—note inversion on February 15. Next are filter paper samples (volume 450 cubic feet) of smog stain—the February 15 sample is almost black. The difference in visibility on the two days is emphasized by the identical views overlooking the Salt Lake Valley.

health impaired and his property damaged by an obvious offender.

The municipal and State governments have an important part to play in the solution of this problem. Legislation seems to be inevitable. However, extreme caution should be used at this time in drawing up rules and regulations, particularly regulations placing maximum allowable limits on the amount of a contaminant which could be liberated by an industry or which may be tolerated in the atmosphere. Such regulations may tend to curtail production and are unjustified in the light of present limited knowledge.

Much research is still needed on the health effect of pollutants, particularly combinations of pollutants. In the meantime, studies should be undertaken by cities and towns to define the extent of the air pollution problem and to determine the major sources of contaminants. Necessary steps should then be taken to correct obvious deficiencies. Municipalities need to review critically their zoning laws. It is folly to permit the development of real estate tracts immediately adjacent to industrial areas. Studies should also be made by the community to determine the prevailing weather conditions, particularly wind direction and velocity; community expansion can then be planned so that new developments are not on the downwind side of heavy industrial areas. Likewise, if the processes of proposed new industries are of such a nature that toxic gases and dust are to be discharged to the atmosphere, every effort should be made to place these industries outside the inhabited area and downwind from major population centers.

There is also need for careful analysis of local topographic and meteorologic peculiarities. Communities located in relatively narrow valleys subject to frequent atmospheric inversions are simply inviting disaster when they en-

courage new industry or industrial expansion. Those industries which are already in the community should be expected to abide by reasonable rules and regulations which have been found to be effective in other areas. Persuasive methods should be used to secure self-initiated corrections on the part of industry. At the same time, the community should realize that it too is quite often a violator of good municipal air pollution standards by virtue of burning trash heaps, allowing the operation of inefficient boiler plants in municipal power generating plants, and permitting inadequate regulations controlling the type of fuel and combustion plants for private homes, apartments, and office buildings.

Industry must adopt the good neighbor policy. A community cannot tolerate a dominant industry. For an industry to be successful, it must learn to live in complete accord with the inhabitants of the community. In selecting locations for future industrial sites, industry must not only consider such items as transportation, availability of raw materials and labor, but it must also add new criteria: topography and meteorology. If toxic chemicals are to be discharged into the atmosphere, it must locate where meteorologic conditions are conducive to the favorable dissemination of smoke and other contaminants unless adequate control of pollutants is assured. Industry must also appraise its stack effluents. It must assure that highly toxic compounds such as beryllium are controlled within narrow limits. This may in some cases necessitate studies to determine the toxicity of new compounds and those metals which have recently gained industrial significance.

Because of the magnitude and complexity of the air pollution problem, the solution must obviously lie in concerted action. An individual industry can rarely afford to engage in specialized toxicologic studies of suspected harmful contaminants. It must therefore draw upon the resources of universities, research foundations and other private organizations, and government. Furthermore, it must accept the community as a partner in a jointly recognized and accepted effort to cleanse the atmosphere of excessive and harmful contaminants. With such a spirit of mutual confidence and unity, we shall be able to cope with the problem before a threatened saturation impels desperate action as in water pollution. Indeed, there is every hope and reason that we can achieve what every citizen is entitled to: an atmosphere reasonably free from chemical pollutants.

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Air Pollution and Man's Health

Three instances of constructive community efforts toward control of atmospheric pollution buttress Doyle's contention in the preceding paper that "we shall be able to cope with the problem before a threatened saturation impels desperate action." The reports "briefed" here were given before the annual meeting of the American Industrial Hygiene Association in Los Angeles on April 23, 1953. Mr. Isaac's complete review of smoke-abatement efforts in Great Britain will appear in the Archives of Industrial Hygiene and Occupational Medicine, published by the American Medical Association. The other two are to be published in full in Modern Sanitation. Of pertinence are two earlier Public Health Reports presentations: Fogs and Deaths in London, December 1952, by John A. Scott (May 1953, p. 474) and The Detroit-Windsor Air Pollution Study (July 1952, p. 658).

In Great Britain

PHR brief

As long ago as 1257, Eleanor, Henry III's Queen, was forced to leave Nottingham because of the coal smoke. The first smoke abatement law was passed in 1273 by Edward I, who prohibited the use of coal as being prejudicial to human health. In 1306, the first smoke-abatement group was "formed" by the lords and others attending Parliament who were annoyed at the increasing smoke. As a result, a Royal Proclamation was promulgated prohibiting artificers from using coal in their furnaces. In 1307, one offender was condemned and executed for this offense.

The agitation against smoke has continued. Today, the emphasis is on using fuel efficiently so as to avoid the production of smoke rather than on the Canute-like attempt to prevent the use of coal. Though the wheel is turning full circle since, in the smokeless zones which have been established in some British cities it is an offense to use other than "smokeless" fuels, which do not include raw coal.

By Peter C. G. Isaac, B.Sc.(Eng.), S.M., lecturer in civil engineering, King's College, University of Durham, Newcastle upon Tyne.

Extent of the Problem

Albert Parker has estimated the sources and extent of the pollution from the combustion of coal and its products and has calculated that the damage to buildings, equipment, fabrics, and agriculture, together with the waste of fuel involved in producing smoke, cost Britain at least £50 million a year. Others have estimated the cost at double this amount, allowance being made for postwar increases of cost.

Measurement of Pollution

The systematic measurement of pollution in Britain was started about 1916 with the introduction of the deposit gauge. Since then, measurements of deposited matter, of smoke, and of sulfur dioxide have been made with the cooperation of an increasing number of local authorities and other agencies. In 1952, there were 140 cooperating agencies: governmental

groups, university departments, and research organizations, as well as local authorities.

Control by Law

Except in the smokeless zones, statute law in England does not cover the private dwelling, and, regrettably, a number of industrial processes are partly or completely exempt. Recourse may be had to common law, however, for a nuisance from any source.

The Public Health Act of 1936, and the Public Health (London) Act of 1936 are the general statutes upon which local authorities mainly rely for preventing smoke nuisance. Under them the local sanitary authority is required to inspect its district for the detection of "statutory nuisances." This inspection is conducted by appropriately qualified medical officers and sanitary inspectors.

Statutory smoke nuisances are defined as any installation for the combustion of fuel for manufacturing processes, or for steam-raising that does not prevent, so far as practicable, the emission of smoke to the atmosphere, or as a chimney which emits smoke in such quantity as to be a nuisance. The model bylaw, which is adopted by many local authorities, defines the second type of statutory smoke nuisance as one in which "black" smoke is emitted for more than 2 minutes in any period of 30 minutes. However, since the domestic chimney is excepted, and since many industries in which black smoke may be an inevitable consequence of the process used are also excepted, it has usually been found much more effective to attack this pollution along the road of fuel economy than by means of summary action under this statute. In addition, local authorities are permitted to group into "joint boards" for the control of atmospheric pollution and to expend money in research and investigation into its causes and control.

The Public Health Act of 1936 also applies to vessels in inland or coastal waters but not to vessels habitually used as seagoing ships.

Under the Railways Clauses Consolidation Act of 1845, steam locomotives must be constructed so as to consume their own smoke.

A fair number of local acts have more stringent requirements. The very considerable improvement in atmospheric conditions in a number of British cities is due, however, to the educational and advisory activities of the sanitary authorities rather than to their wielding of the statutory "big stick."

Prior Approval

It would seem that prior approval of furnaces in Britain is less effective than in the United States because nowhere is it mandatory. However, a number of cities have statutory provisions for voluntary prior approval.

The first legal provisions for prior approval were embodied in the Manchester Corporation Act of 1946. These require that no furnace shall be installed unless it is, so far as practicable, capable of being operated continuously without emitting smoke—this does not apply to single dwellings. If the detailed plans of such a furnace are submitted for prior approval and either receive approval or do not receive disapproval within 6 weeks, no action can be taken against the person installing the furnace. Before the corporation can serve a notice expressing disapproval, it must consult with the Minister of Fuel and Power. In establishing what is "so far as practicable," due account must be taken of cost and of local conditions. Although the submission of plans for prior approval is seen to be voluntary, it carries the incentive of removal of the threat of proceedings.

Smokeless Zones

Smokeless zones were first suggested in 1935. Now a well-established policy of the National Smoke Abatement Society, their wider adoption must greatly depend on the educative efforts of the society and similar groups. With the present shortage of fuel in Britain, the adoption of smokeless zones is most usefully coupled with stressing the more efficient use of fuel. The houseowner, who may be chary of the capital outlay on replacing the traditional open grate by a more efficient, and less smoky, fuel-burning appliance, can be attracted by the prospective savings in fuel costs. The cost and the shortage of smokeless fuels are major obstructions to the general adoption of smokeless zones.

Efficient Domestic Stoves

Most of the coal used domestically in 1948 (37 million tons) was burned in open grates and kitchen ranges of traditional design and low efficiency. Although about half the present domestic consumption of coal could be saved by its more efficient use, a very much smaller saving would, no doubt, be effected since the greater efficiency of the newer appliances would be used to provide greater comfort for the same fuel outlay.

Within recent years, many manufacturers have made successful efforts to design more efficient fires and stoves for domestic heating. The Fuel Research Station of the Department of Scientific and Industrial Research has tested many of these appliances, and the Minister of Health in consultation with the Minister of Fuel and Power and other Government departments has issued a list of approved appliances.

The sale of these newer and more efficient appliances has greatly increased since the end of the war. Increasing attention is being paid to improving the insulation of houses so as to conserve heat and so to reduce the amount of fuel used.

Fuel-Saving in Industry

It is in industry, perhaps, that the greatest strides have been made in the more efficient use of fuel, especially in the generation of electricity which now requires about 30 million tons of coal a year. In 1921, 1 kilowatt-hour of electricity required 3.4 pounds of coal; now, only 1.4 pounds is needed.

During the war, in order to eliminate from merchant ships the telltale smoke plumes that occurred soon after firing, the Fuel Research Station designed smoke-eliminator doors for the furnaces. These provided the extra secondary air when it was needed. This principle has now been extended to the design of smoke-eliminator doors for a number of shell-type boilers.

The Ridley Report

The recent report of the Committee on National Policy for the Use of Fuel and Power Resources (the Ridley report of 1952) is most germane to this issue of fuel efficiency and smoke abatement. It makes the following recommendations:

Development of more efficient types of open fires to burn coal more efficiently and smokelessly.

Increased use of gas for domestic heating during peak loads on electricity generation.

Expansion of the fuel-efficiency advisory service.

Financial incentives to firms installing efficient equipment for combustion.

Prior approval for industrial and commercial heating plants.

More training schemes for stokers.

Replacement of steam railway locomotives by other types.

Wider use of low-temperature carbonization for production of smokeless fuels.

More general adoption of smoke abatement bylaws under the Public Health Act of 1936.

More smokeless zones.

In Detroit

PHR brief

Detroit's present air pollution control program was started in 1947 when a committee of the Engineering Society of Detroit, at the request of the Department of Buildings and Safety Engineering, drafted a comprehensive air pollution control ordinance. Upon enactment of the ordinance, which replaced Detroit's smoke abatement ordinance, the Bureau of Smoke Inspection and Abatement was reorganized on an engineering control basis with a staff of 3 engineer administrators and supervisors; 17 air pollution inspectors; 5 office personnel; and 2 chemists, classified as industrial hygienists.

The air pollution control ordinance is enforced primarily by obtaining compliance. Court action is resorted to only for recalcitrants

By Benjamin Linsky, M.S.E., P.E., chief smoke inspector of the bureau of smoke inspection and abatement, Department of Buildings and Safety Engineering of the City of Detroit.

because, when a case reaches the courts, the bureau believes it has failed to "sell" the requirements of the community to the violator.

Control Alerting

Visible air pollution is controlled in Detroit by 15 district air pollution inspectors as well as by an observer for the bureau who dispatches two radio-equipped automobiles manned by air pollution inspectors. The observer watches for the sources of excessive air pollution, while they are active, from any one of several high buildings in different parts of the city. Citizen complaints are also served by the radio-equipped automobiles.

Measurements of "streetosphere" concentrations of pollutants are obtained to evaluate the need in a specific neighborhood for corrective work at a specific point source and to correlate such concentrations with various kinds of effects. Stack samples are obtained when it is necessary to evaluate air pollution emissions at the source.

Local industries and city departments operating large plants have been persuaded to engage in research and development when no technical controls for specific air pollution emissions were known. Examples of some recent and current projects are:

An intensive examination by the Chrysler Corporation of its problem of controlling dirtying particles from the continuous melt gray iron electric furnaces at its Dodge-Winfield plant.

The research by the city departments of public works and water supply into the problems of collecting dust particles from high-temperature gases at incinerator and sewage disposal plants.

The Aurora gasoline refinery's development of a neutralizer for odorous gases from a spent-caustic regenerator.

The over-fire air system of the Detroit Edison Company for reducing smoke from its large multiple-retort-stoker-fired steam generators.

Results Over 5 Years

About $14 million has been spent for installations of direct air pollution control in 5 years. This sum is for corrections required by violation notices from the bureau and does not include the large number of equipment changes made where installation permits were not necessary.

Horizontal visibility, in the absence of rain, fog, snow, or sleet, has increased measurably. Dustfall in industrial areas has been reduced.

More than 140,000 tons of fly ash a year is now being caught in fly ash collectors. Large tonnages of chemical and other dusts are also being caught. Emissions of industrial gases such as hydrogen sulfide and hydrofluorosilicic acid have been reduced.

Smoking chimneys are fewer and less frequent. A white shirt can be worn a full day. Fly ash does not accumulate along curbs and in store doorways.

Cooperative Control Efforts

The Bureau of Smoke Inspection and Abatement engages in limited research work, when no industrial sponsorship can be obtained. It freely exchanges ideas with other air pollution specialists in public agencies and in private industry. Its activities are deliberately and conscientiously integrated with related local agencies. Thus, the planning and zoning agencies are sources of reports of neighborhood problems as well as recipients of technical air pollution data and recommendations from the bureau. The bureau works continuously on improved air pollution instrumentation in cooperation with the division of industrial hygiene of the health department.

Similarly, solutions to air pollution problems which involve fire hazards are worked out cooperatively with the fire department. The local water pollution control agency is consulted about wet methods of air pollution control. Health effect determinations made by the health department guide the bureau's engineering control work.

There is still another relationship between the bureau and the Detroit Department of Health. To avoid duplication of specialized laboratory facilities, special sampling instruments and the two industrial hygienists in the bureau are stationed in the laboratory of the industrial hygiene division of the health depart-

ment. These men work under the direct supervision of the division, performing general industrial hygiene work with emphasis on air pollution sampling and analysis. When the bureau requires such measurements, the industrial hygiene division assigns men to work with the bureau's engineers and air pollution inspectors. The measurement data is then sent to the bureau for evaluation and use. Thus, in exchange the bureau is entitled to 2 man-years of air pollution measurement work per year from the industrial hygiene division.

Detroit-Windsor Study

As a byproduct of Detroit's request for abatement of the nuisance caused by smoke from ships plying the Detroit River, an international waterway, the Detroit-Windsor air pollution study of the International Joint Commission (IJC) of the United States and Canada was started. Recognizing parallel interests in various phases of the study, several local community groups in the Detroit area have contributed services, equipment, personnel, and funds.

The Detroit Edison Company erected pole supports and furnished high-volume filters. The Detroit Department of Health employs and supervises the health effects staff for the Detroit portion of the study. It also sponsored the stack-sampling course at the University of Michigan. The General Motors Corporation furnished all facilities for the joint industry conferences on the air pollution study.

The bureau pays the rent for the quarters of the United States section of the IJC Technical Advisory Board. The bureau serviced most of the high-volume filters daily and scheduled its Thomas autometer so that data could be coordinated with the IJC Technical Advisory Board's autometer. It also prepared detailed pollution source maps.

The area-wide Detroit-Windsor study will determine valid correlations between air pollutant concentrations and the effects on vegetation, corrosion, soiling, visibility, and health detriment. Already under way are a vegetation effects study and a pilot field study of health effects of urban air pollution in both Detroit and Windsor.

In Los Angeles

PHR brief

Comprehensive investigations on the causes and effects of air contaminants in the Los Angeles area show that, for the present, air pollutants can be related to such effects as reduction in visibility, eye and throat irritation, damage to vegetation, and local nuisance.

The Smog Mixture

Aerosols, gases, and vapors are the principal ingredients of smog in Los Angeles County. Dusts, smoke particles, and condensed fumes are obvious pollutants—detrimental because of physical characteristics causing reduction of visibility. The atmospheric oxidation of sulfur dioxide to sulfur trioxide and the formation of sulfuric acid mist contribute to this effect. Where atmospheric conditions provide time for the oxidation of certain hydrocarbons in the air, the polymerization of the oxidation products add to the haze. Droplets of organic acids and peroxides undoubtedly exist under certain moisture and temperature conditions. These, too, result from hydrocarbon reactions in the air.

The vapor or gas phase of smog is predominantly hydrocarbon. Olefinic, branched-chain, and cyclic compounds present in gasoline vapor are readily oxidized in the presence of sunlight and oxides of nitrogen to produce gases which are eye-irritating and damaging to vegetation. Ozone, a byproduct of the photochemical reaction, further aids the oxidation and leaves a residual ozone concentration which may reach nuisance proportions in the mass of polluted air. The Los Angeles studies have shown that the presence in the air of quantities of aldehydes, organic acids, and peroxides is largely accounted for by the reactions which occur.

Samples of the air taken under intense smog conditions in Los Angeles were analyzed by acceptable methods for identifying microquan-

By Gordon P. Larson (Lt. Col. Ret.), director of the Los Angeles Air Pollution Control District since 1949.

tities of materials. The results are shown below:

Aerosols

Ether-soluble aerosols.	Lead.
Sulfuric acid mist.	Aluminum.
Carbon.	Calcium.
Silicon.	Iron.

Gases and Vapors [1]

Acetylene.	Methyl chloride.
Aromatics.	Nitric oxide.
Benzene.	Nitrogen dioxide
Isobutane.	Nitrous oxide.
n-butane.	*n*-pentane.
Butenes.	Phosgene.
Carbon tetrachloride.	Propane.
Ethane.	Propylene.
Ethyl benzene and/or xylene.	Sulfur dioxide.
Formic acid.	Toluene.
Methyl Cellosolve	Trichlor ethylene.

Unsaturated hydrocarbons ranging from C_3H_8 to $C_{12}H_{24}$.

Products of oxidation of the above unsaturated hydrocarbons (aldehydes, peroxides, ketones, and organic acids).

[1] In addition to normal gaseous constituents of the atmosphere.

The aerosols are listed in order of importance as they affect visibility, which has been determined by a relative pollution index.

Results of Controls

Control efforts in Los Angeles have been highly gratifying. Over 600 tons of air pollutants once discharged daily into the atmosphere are now being withheld. Industry accomplished this by spending over $12.5 million for control equipment.

Valuable sulfur is recovered by the 360-ton daily reduction of sulfur dioxide at the refineries. The amount of sulfur dioxide in the atmosphere has been reduced by 50 percent. Refineries have reduced losses of gasoline vapor, recently identified as a pollutant, by 100 tons a day.

Control equipment on metallurgical plants, in rock-crushing, asphalt paving and grinding processes, and in the food, paint, roofing, fertilizer, and soap industries is daily collecting 70 tons of dust, fumes, and other aerosols.

The efforts of the Air Pollution Control District of the County of Los Angeles to improve combustion, especially in industrial and commercial incinerators, and to eliminate smoke at burning dumps have accounted for the removal of 60 tons of smoke, 50 tons of organic acids, and 10 tons of aldehydes from the air. The dieselization program of railroads has further reduced contamination from smoke.

As a result, the number of days of intense smog has decreased; the average visibility has increased; and the concentration of many pollutants has decreased. However, the level of atmospheric pollution is still too high. No end is in sight to the rapid increase in population and the expansion of the industrial community. Estimates indicate a growth to 16,000 industrial plants and 6,000,000 persons in Los Angeles County by 1960.

New Frontiers for Study

Certain phases of the Los Angeles smog problem must still remain in the hands of the scientists and development engineers. Useful information for air pollution zoning programs is very much needed. In Los Angeles, the expansion of the community, and the critical weather conditions which prevail for 270 days each year, make it necessary to minimize the effects of the contaminants which remain after engineering controls have done the best possible job.

In order to ascertain the average wind currents, the Air Pollution Control District's meteorology department now collects wind data from over 30 stations. This study, requiring at least 3 years to complete, will be used in conjunction with the comprehensive data already obtained from air sampling and source analyses programs.

Over 6,000 tons of waste material must be disposed of daily in Los Angeles by industry, commerce, and private residents. Although improved equipment and techniques have materially reduced smoke emissions from the first two sources, domestic rubbish contributes an ever-increasing amount of atmospheric pollution. Research should be directed to the field of combustion and to the means of conserving valuable materials in rubbish. Composting certain wastes for use as fertilizer or recovery of the heat value should be aggressively explored. New ways for using and disposing of rubbish

would be a boon to every metropolitan area and a great step forward in reducing air pollution from millions of incinerators.

The physiological effects of air pollution is a virtually untouched field. Many living in industrial areas believe their health is being impaired. Controlled experiments are extremely difficult because of the relatively low concentrations of most contaminants. Where submicron dusts or fumes are involved, fundamental research has progressed to a point where some experiments can be undertaken, but years of research will be required for even preliminary answers.

The control of gasoline vapor is another major problem. Despite the amount now kept out of the air in Los Angeles, about 500 to 700 tons a day are still escaping from the processing and distribution of gasoline. Methods to correct losses should be pressed forward. Refinery processes, evaporation losses, and transfers of gasoline from tank to tank are the main control points.

The release of hydrocarbons from automobiles requires detailed study. While some preliminary research has been started in Los Angeles, much remains to be done. Evidence indicates that the exhaust from vehicles may be an item for control measures. Before any action can be taken, the contribution to general air pollution of a community, or to the street-level nuisance effect, must be clearly demonstrated.

Other projects such as the reduction of sulfur dioxide from coal- and oil-burning equipment, improved fly ash collectors and basic studies on filter media, analytical methods, and instrumentation are being undertaken by many research organizations. It is recognized that these studies will assist the control efforts of industry and government, but it is short-sighted to ignore problems which appear on the horizons of our growing communities.

Increased populations, technologic changes in industry, and the use of new products generate new community problems before the old ones are solved. A striking example in the field of air pollution control lies in the fact that techniques are not available for full protection to a community against potential radiation hazards, which could develop from the wide use of radioactive materials in industrial processes.

Public Health Service Staff Announcements

Dr. H. Van Zile Hyde, chief of the Division of International Health, Public Health Service, has been appointed by the President to serve as United States representative on the Executive Board of the World Health Organization. His appointment was confirmed by the Senate on July 20, 1953. Dr. Hyde previously held the position of United States representative from May 1948 to May 1952, which encompassed the first two terms of the United States' membership on the Board. In May 1953, the United States was elected by the Sixth World Health Assembly to its third term.

Dr. Hyde, for several years active in international health affairs, most recently as director of the health and sanitation staff, Technical Cooperation Administration, has been chief of the Division of International Health since March 1, 1953. This division, transferred from the Office of the Surgeon General to the Bureau of State Services on April 1, 1953, is also responsible for recruitment of personnel for the public health missions of foreign assistance programs, technical supervision of their work, and placement of foreign personnel for professional training.

Dr. Frederick J. Brady, international health representative in the Division of International Health, has been appointed by the President to serve as alternate representative on the WHO Executive Board.

Dr. John R. McGibony, chief of the Division of Medical and Hospital Resources of the Public Health Service since 1949, has been appointed professor of medical and hospital administration and director of the course in hospital administration in the Graduate School of Public Health of the University of Pittsburgh. A commissioned officer of the Public Health Service since 1936, Dr. McGibony contributed to the planning and development of the Hospital Survey and Construction Program. In 1946 he became assistant chief of the Division of Hospital Facilities. Prior to this appointment, he served first as hospital administrator and then as director of health for the Bureau of Indian Affairs, Department of the Interior. In recent years, Dr. McGibony was also hospital consultant to the National Security Resources Board and the Federal Civil Defense Administration.

The Teaching-Learning Situation

By GORDON W. ALLPORT, Ph.D.

Principles derived from the psychology of learning and of human relations can be applied to medical teaching. A widely known Harvard psychologist tells coordinators of cancer teaching about the need for teacher enthusiasm for the subject being taught . . . the classroom lecture and its participants . . . the student's growing-edge and his ego-involvement . . . and possible methods for imparting the skills needed to reduce patient anxiety.

IN GENERAL, the rules for effective teaching and retentive learning that I offer here somewhat dogmatically are as valid in the field of medical education as in the field of liberal arts. For whether as teachers our aim is to communicate the principles of cancer, of psychology, or of English composition, the basic rules are essentially identical.

The first requirement for successful teaching is too obvious to require explanation: The teacher must himself possess expert and up-to-date knowledge of his field. The only comment on rule number 1 is that while it is a necessary principle of good teaching, it is by no means a sufficient principle. Plenty of men with expert knowledge are failures as teachers.

The second requirement reaches into the domain of temperament. A good teacher needs to have a contagious enthusiasm for his subject, by which I mean he should be intellectually noisy. Not that he must be loud in voice or garrulous. His manner may be soft or bold, his voice quiet or loud, his bearing assertive or genteel. But there must be a tonicity of interest and a pressure to communicate that convince the student that something of vital importance is gripping the teacher's mind.

For teachers who feel timid and unsure in meeting a class, there is a reassuring principle. Be yourself. If you know your subject and are reasonably prepared, then forget all about your appearance, even your tics, your stammer, your mannerisms, and your neurosis. Teaching is not acting; it is not oratory; it is not salesmanship. Unlike these vocations it does not depend on superficial address. It is a deeper process of communication. It can proceed successfully, no matter how unfavored the teacher is by nature, provided he wants to convey his more adequate information about a subject to a student who wishes to learn.

The Student's Growing-Edge

So much for the teacher's own equipment and personality. Look now at the interaction process itself, at the devices the teacher may use to enhance the success of his efforts.

I emphasize the need for any teacher to know where the student stands now in his knowledge. The target should always be the growing-edge of the student. It is true that at a given time

Dr. Allport, member of the National Commission for UNESCO and formerly editor of the Journal of Abnormal and Social Psychology, is author of Personality: A Psychological Interpretation and other books.

no two students have precisely the same growing-edge. One has more knowledge than another; one has read the assigned textbook, another has not. The identical point made by a teacher may strike fire in one student and leave another cold. Even so, a medical teacher—any teacher—can acquaint himself with the previous average preparation of the students, assuming neither too much nor too little knowledge on their part. If in doubt, the instructor can always inquire of the group what the stage of their training may be. Three minutes taken at the beginning of the hour for this purpose are well invested. Unless I am mistaken this principle needs to be observed especially in medical education where specialist teachers are likely to be unacquainted with the background in fundamentals that the student brings.

The principle just mentioned does not, of course, preclude the need for review. To spend the next 5 minutes of the hour in reviewing the fundamentals of the subject is like laying fresh cement to hold the new bricks in place.

Talking reaches only the ear. The blackboard reaches both eye and ear. Why not give the student two chances for his money rather than one? For the comprehension of more difficult material investigations have shown that visual reception is superior to auditory. While not all audio-visual aids are effective, the teacher's duty is to keep abreast with audio-visual and demonstrational aids so they may be used if in his judgment they promise to be effective.

Return, for a moment, to the student's growing-edge. Those who are just entering into the study of a special topic sometimes complain of the tendency of some instructors to nourish their own edge rather than the student's. They cite the habit of some teachers who devote the instructional hour to some current article in a technical medical journal dealing with a small point of interest to the teacher but far too specialized for the student's current need. Even when the citation is accompanied by wholesome enthusiasm and excitement on the part of the teacher, it is basically a self-centered and not a student-centered device, unless, as occasionally happens, the journal article falls at the student's growing-edge. On the whole, the device seems more suitable for the instruction of interns and staff than for younger medical students. The principle, being stressed here, says: Let the elementary student's present need, not the instructor's current enthusiasms, channel the instruction.

A synapse, we are told, may stop conducting if overcrowded by nerve impulses. So too may a student's mind. A common type of overcrowding is the recital by the instructor of endless statistics. They cannot be understood, certainly not retained. Round figures, in most cases, will fix the point in mind with sufficient accuracy. Learning will be aided if the amount of material to be assimilated within the hour is kept to manageable proportions, and the unessentials are trimmed out.

Invariably students praise instructors who know how to organize the material well. It is safest for most of us deliberately to follow a prepared outline. A medical student told me that he thought the subject of cancer had a natural, intrinsic, organization of its own. Whether he was right, or was unconsciously reflecting superior teaching, you can judge better than I.

Recent research has—broadly speaking—put the lecture on the defensive as a pedagogical method. Its potential virtues, however, are considerable. It can give perspective, inspire enthusiasm, and summarize much material from varied sources. But it can only do so if it is orderly in arrangement and distinguishes the highlights of a subject from lowlights.

There is no single method of employing a textbook to best advantage. Some effective teaching follows the text closely, never of course with monotone repetition, but with the purpose of underscoring important points, and made vivid through added example and personal experience. It seems a safe rule that the instructor should never disregard completely the assigned reading. The student is expected to integrate reading with oral teaching; it is only fair for the teacher to give what aid he can. Such integration is especially important for the beginning student.

Student Participation

Some of the principles may seem little more than pedagogical routine. Yet they have a

bearing on the most important of all factors in the teaching-learning situation—the motivation of the student to learn. Granted that a medical student is thoroughly committed to his chosen profession and suitably goaded by poverty, by zeal, or by spouse to pass the endless array of requirements, there is still the fact that one medical subject may seem to him dull and lifeless, and another may inspire him to put forth maximum learning effort. What principle is the teacher of the first subject failing to observe? Why is his subject as he presents it dull and dead?

In all probability he is failing to maximize the student's opportunity for participation. A student learns more by doing than by listening. The educational philosophy of John Dewey is certainly correct in stressing this generalization. So too is the Chinese adage:

> When I hear it I forget it
> When I see it I remember it
> When I do it I know it

The Role of Lectures

Lectures have their place. They can properly supplement participation, or, to a greater extent than most lecturers realize, they can evoke it. When the student asks a question, he is participating. When he is asked to look up the answer and report back to the class at the next hour, he is participating still more. He is less likely to forget the information than if the instructor, like an oracle, pronounces the answer. Such participation can be woven into a lecture, though available time limits its use. When a diagnosis is called for, let the student try his hand at it before the instructor makes his pronouncement. And—very important—give the student plenty of time to reach his decision, so that he may know that his best effort at the task has succeeded or failed. I wish that all teachers of all subjects would obey the rule to give the student time. It is a common failing, especially on the part of the insecure teacher, to choke off a student wrestling with a problem, and himself to supply the answer before the gains of participation have been achieved.

Participation is a large subject. It covers student questions, recitations, prepared papers, practice diagnoses, laboratory work, case presentation, and much else besides. A particularly effective method for participant study is the assignment of questions in advance for a coming examination or for the next day's class work. In the latter event it is well for the student to correct his own paper, spotting his own errors and thus cultivating his own growing-edge.

The law of participation has, of course, a mundane practical side. The possibility of participation is normally in inverse ratio to the size of the group being taught. Medical schools surely know this fact; else it would be difficult to explain and justify the severe restrictions on the size of entering classes. In teaching the radiological aspects of cancer, for example, one can do with a cluster of five or six students what one cannot do with thirty. But we should not take refuge in this easy alibi. Even in a large lecture class alert teachers can often discover small ways to elicit participation. Instead of droning on for an hour without interruption the teacher can have his listeners in their seats perform small experiments or write down what they think are the right answers to certain questions which later will be answered by the lecturer. There are more devices to elicit participation than we teachers realize.

Ego-Involvement

But participation has deeper psychological significance. Who participates? It is surely not the hands and voice of the student. It is, if I may introduce the term, his ego. In recent years psychologists have had much to say concerning ego-involvement. In one sense ego-involvement is basic to all learning; in another limited sense, it impedes it. In the broad sense, favorable to learning, we may say ego-involvement is more or less identical with interest. By a principle of susidiation a student will learn to absorb and organize material that is consonant with his own interest system. The instructor will elicit this form of ego-involvement if he is successfully aiming at the present growing-edge of the student, and if by his own example he conveys enthusiasm for the subject.

In a more restricted sense, ego-involvement means self-esteem. Even a medical student—

burdened and misshapen as he is by poverty and prescriptions—is strictly normal in respect to his human sensibilities. For him, as for all learners, praise is a great incentive. If he does a good job he wants to know it. Next time he will deliver an even better performance.

But if praise is favorable to the effective acquisition of knowledge and skill, ridicule and embarrassment are not. Here we come to a curiously sadistic teaching-learning situation that has nothing to be said for it. Why some teachers like to pounce on a given student without warning, and with fierce aggression demand that he produce the precise point that the teacher has in mind at the penalty of being ridiculed, is a question in the psychopathology of teachers that we shall not explore. The principle in question can be summarized by saying that to raise the student's self-esteem is a mark of good teaching; to lower it is (with very rare exceptions) a mark of bad teaching.

Reducing Patient Anxiety

There is one important special skill that every medical student—especially those dealing with cancer patients—must acquire. How to learn this skill poses a major problem for the teaching-learning situation. The alleviation of the patient's anxiety is one ability that certainly cannot be taught by lectures. How then may a student learn it? Unless I am badly mistaken, medical education in general and cancer education in particular pay too little attention to this difficult pedagogical problem.

Recently I reviewed data collected in connection with a project in cancer research. The problem concerned reasons why women with breast lesions had delayed in seeking treatment even after they suspected the nature of their difficulty. I am not prepared to offer a statistical report of this research, but the large number of cases where the physicians themselves seemed at fault was disturbing to me. They aroused so much anxiety that the patient repressed the matter, disbelieved the doctor, or took refuge in some other form of psychological defense. Disturbing too were the cases where patients reported callous acts on the part of doctors. In one case, following an examination, three physicians held their consultation in the corner of the woman's hospital room; then left the building without speaking to her. For days she lay in agonized doubt, without knowledge of her condition and without the clearly indicated supportative psychotherapy.

Most experienced physicians, I know, behave very differently. Many make it their first duty to allay anxiety to the best of their ability. I am not here presuming to raise the disputed question as to how much a patient should be told about his condition. My point is merely that however much is told it can be told so as to relieve anxiety to the maximum degree possible.

How is the reassuring manner to be learned? What approaches may be used in breaking bad news? For that matter, how can any physician in any kind of case help lift the patient over his psychological hurdles? A young medical student—especially one not temperamentally gifted in this regard—has much to learn. While I am not wise enough to solve this difficult problem, I can offer two teaching devices that have been successful in modern attempts to give instruction in the field of human relations. Possibly you may see merit in one or both of them for the teaching of doctor-patient relations.

Apprenticeship

The first device is an extension of the ancient method of apprenticeship, aided by modern technology. Perhaps as an understudy to a skillful doctor, both in his technical work and in his human relationships, a student would be given a model from which to pattern his own efforts. But there are limitations to apprenticeship. Can a medical student accompany a physician who is about to tell a patient that he will die of carcinoma of the liver? Modern technical developments include the possibility of hidden recordings, also of using one-way screens made of molecular chromium glass. Granted that these devices are not adapted to home calls, is there the possibility that they can be employed effectively in hospitals for the teaching of doctor-patient relations, not only when matters of life and death are involved but in other situations calling for skilled efforts at anxiety-reduction?

I realize that this suggestion, made most tentatively, raises problems of medical ethics. Does it differ significantly from ward rounds, attendance at operations, or other occasions where medical students are introduced to intimate personal relationships? In certain psychological laboratories the ethical problem of using hidden recordings has been met in the following way. The subject (patient) is later told that a recording was made for teaching purposes. If he will permit it to be so used the investigator will be grateful; but if he prefers that it not be so used the recording is straightway destroyed. The one-way screen does not, of course, permit this ethical safeguard. But it too may have its limited uses, for example, in cases where a patient gives advance consent.

Psychodrama

The second suggestion raises no problems of ethics. It concerns the possible employment of role-playing in cancer education. Let one young medic play the part of a patient who is to be told that he has an operable malignant growth. Let another play the role of his physician. The situation can be specified somewhat more fully. The patient, let us say, is 45 years old, father of a family, worried about expenses, as well as about the possible outcome. The physician in his own mind is not too certain that the outcome will be favorable but like all physicians he holds the optimistic bias. Innumerable situations of this sort can be invented to start off the psychodrama. When the play has run its course, there can be class discussion and criticism of the "physician's" behavior. The class instructor may have suggestions to make. The scene can be played again until it meets general approval. The actors can, and should, reverse their roles. And every student in the class can, and should, have extended practice.

This method can helpfully expand and deepen the experience the student now gets through his attendance at clinics. Situations he has observed can be more fully explored through acting them out. Hypothetical situations that anticipate his own later responsibilities can be used. The process of role-playing, awkward as it is for the tyro, can in time confer upon him flexibility in manner and an invaluable understanding of the patient's point of view.

It is true that teachers who would employ this method themselves need training in its use. There are experts in psychodrama who would, if asked, turn their attention to the field of doctor-patient relations, and if it seems desirable, conduct a workshop in the technique for the benefit of interested medical teachers.

It does no good, I feel certain, to tell a medical student that he should allay anxiety, that he should be sincere, reassuring, quiet, calm, confident. He needs concrete example and he needs practice in human relations. I hope that in the future medical, especially cancer, education will develop methods to train in these skills, and thus rub off in advance some of the rough edges of young practitioners.

Apart from the problem of alleviating anxiety all of the features of the teaching-learning situation that I have mentioned are common pedagogical property. The principles I have stated with such brevity derive from the psychology of learning and from the psychology of human relations. Experience has found them to be sound guides to teaching. I hope that some of them may have suggestive value for you.

The Development and Evaluation Of Cancer Diagnostic Tests

By JOHN E. DUNN, Jr., M.D., and SAMUEL W. GREENHOUSE

ANY ATTEMPT to bring the majority of human cancer cases to clinical recognition in a curative stage, at least until new therapeutic methods are established, involves the ability to recognize the disease in an asymptomatic individual. Searching the general population for unsuspected cancer using clinical procedures has been explored through cancer detection centers, but has been found to be impractical because of the inadequate capacity of such facilities and the relatively high cost per examinee.

The need for a procedure to indicate the existence of unsuspected cancer has led to many attempts over the years to devise a laboratory procedure that would show whether or not an individual is harboring a cancer. These procedures have usually taken the form of chemical, biological, physical, or immunological measurements on readily available human materials such as blood, urine, and exudates, or of skin tests.

A priori it can be said that the possibility of developing such a diagnostic test for a disease is dependent on unique and specific substances produced by or as a result of the disease, which can be measured by laboratory procedures; or by quantitative changes in normal body con-

Dr. Dunn directed the field investigations program of the control branch, National Cancer Institute, National Institutes of Health, Public Health Service, from 1948 until his present assignment to the California Department of Public Health at Berkeley. Mr. Greenhouse is a statistician in the biometrics section of the technical services branch, National Cancer Institute.

Public Health

MONOGRAPH

No. 12

The accompanying article discusses the principal findings presented in Public Health Monograph No. 12, published concurrently with this issue of Public Health Reports. These papers, by authors from the Medical College of Alabama, Tufts College Medical School, the Schools of Medicine of the Universities of Washington, Tennessee, and Kansas, and the Research Laboratory of the Jewish Memorial Hospital, Roxbury, Mass., were assembled by the National Cancer Institute, National Institutes of Health, Public Health Service.

Readers wishing the data in full may purchase copies of the monograph from the Superintendent of Documents, United States Government Printing Office, Washington 25, D. C. A limited number of free copies are available to official agencies and others directly concerned on specific request to the Public Inquiries Branch of the Public Health Service. Copies will be found also in the libraries of professional schools and the major universities, and in selected public libraries.

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Evaluation of cancer diagnostic tests. Public Health Monograph No. 12 (Public Health Service Publication No. 275). U. S. Government Printing Office, Washington, 1953. Price 30 cents.

stituents that are more or less uniquely associated with a specific disease. Various immunological tests for acute infectious diseases are classical examples of the former, and the glycosuria associated with diabetes mellitus, of the latter. Unfortunately, cancer research has not as yet demonstrated well-established qualitative changes, either in cancer tissue as such, or in the host organism supporting the cancerous growth. Quantitative changes are known to occur in cancer tissue as compared to the corresponding normal tissue. Also, there are quantitative changes in the host, but these changes are not uniquely associated with cancer. The question, then, becomes one of whether a proposed diagnostic procedure based on empirical observation is perhaps founded on a mechanism that is yet unknown or not fully elucidated in the mass of cancer research knowledge, or whether the known quantitative host changes, singly or in combination, might not serve as a means of distinguishing cancerous from normal individuals and from those with other diseases.

In general, attempts to find a diagnostic test for cancer have been met with an attitude of pessimism since the body of cancer research knowledge has apparently not yet established a firm basis for development of such a test. On the other hand, those faced with the urgent demand that something be accomplished now to reduce human cancer mortality are confronted with the necessity of taking calculated risks.

In 1948, several university groups indicated an interest in exploring proposed cancer diagnostic tests to determine their usefulness by requesting grant funds from the National Cancer Institute. These projects were approved by the National Advisory Cancer Council and a loosely coordinated program was developed in which the five university groups looked to the cancer control branch of the National Cancer Institute for liaison and technical assistance in the analysis of data. The five groups carrying on this work are under the direction of:

Dr. Stuart W. Lippincott, professor of pathology, University of Washington Medical School, Seattle, Wash.

Dr. F. Homburger, director, cancer research and cancer control units, department of surgery, Tufts College Medical School, Boston, Mass.

Dr. J. K. Cline, chief, cancer research department, Medical College of Alabama, University of Alabama, Birmingham, Ala.

Dr. Douglas H. Sprunt, director, Institute of Pathology, University of Tennessee Medical School, Memphis, Tenn.

Dr. Robert E. Stowell, professor of pathology and oncology, University of Kansas Medical Center, School of Medicine, Kansas City, Kans.

The principal aims of this program were:

1. To determine whether any of the many diagnostic tests for cancer proposed in the past meet the original claims made for them by their developers when carefully evaluated by another laboratory.

2. To follow up any leads in basic biological, chemical, or biochemical research bearing on the diagnostic problem and possibly leading to the development of a test.

Additional purposes served by this program, purposes that were made apparent only after the program had been under way, were:

1. To provide a much needed statistical methodology in order to unify and make comparable different evaluations of the same test and also evaluations of different tests.

2. To utilize the experience and facilities of the participating groups to evaluate tests developed currently.

3. To obtain leads meriting further investigation resulting from the analysis of data collected by the various groups.

The purpose of this paper is to describe briefly the accomplishments of this program in fulfilling these aims. Much of what follows has already been said or reported elsewhere; the remainder is new.

Methodology

In order to evaluate the practical usefulness of cancer diagnostic tests, the performance requirements for a useful test must first be decided upon. Since the primary objective was a test that would indicate the probability of unsuspected cancer, the requirements of a case-finding or general population screening test were given primary consideration. Criteria were proposed and a statistical method for analyzing data on the basis of these criteria was developed (*1*). It was realized that a test would have other uses as well, such as for differential diagnosis in a diseased individual. Evaluation studies, therefore, included patients with

diseases other than cancer. However, it appeared reasonable that a test that would not distinguish satisfactorily between individuals apparently free of disease and those with cancer could not distinguish the latter from other diseased individuals.

Most of the general tests proposed to detect the presence of cancer are blood tests, based on the principle that some factor, for example, the blood proteins, enzymes, or an immunological agent capable of reacting with an antigen, appear in the blood serums of cancerous individuals and either are lacking or are quantitatively different from that in the blood serums of normal individuals. Measurement of this factor in a group of normal individuals and in a group of individuals with known cancer, in most cases, gives rise to a continuous variable more or less symmetrically distributed about a modal value which differs in the two groups. To make this process a diagnostic procedure it is necessary to select one value of the variable, the so-called critical value, to serve as the dividing point for future tests. If a person's measurement, say, exceeds the critical point, he would be classified as positive; if it falls below, he would be called negative. (In the past we have stressed the fact that no single test can do more than result in these designations and only provides evidence that a person called positive has some probability of having the disease. It is only after a person so classified has undergone clinical study that cancer can be diagnosed.) Once the critical point has been selected for any set of data, it becomes possible to refer to two measures inherent in the test, namely, the proportion of false negatives (sensitivity) and the proportion of false positives (specificity). These measures are completely dependent upon the choice of critical value and, in fact, vary as the critical point varies. We illustrate this in the following tabulation, based on an evaluation of the Huggins iodoacetate index by Homburger and associates (*2*).

Critical value:	*Percent false positives*	*Percent false negatives*
5.3	5	55
5.9	10	43
6.8	20	24
7.8	40	17
8.6	60	9

The implications in analyzing evaluations of diagnostic tests are clear. Contrary to past experience, an evaluation must not adhere blindly to the same critical value reported by the originator. The investigator must find the critical value that will give either the same specificity or sensitivity as that obtained by the originator and then compare the remaining measure. For example, if, from the previous table, one were to advocate the Huggins iodoacetate index because it gave 24 percent false negatives for 20 percent false positives, then the purpose of an evaluation is to confirm that this procedure gets 24 percent false negatives for 20 percent false positives. The investigator evaluating the test collects his own data and attempts to reproduce the biological and chemical aspects of the procedure as carefully as he can. Often biases exist but, even if they did not, characteristics of the distribution, such as the critical point giving 20 percent false positives, are subject to sampling variation. (Our experience has been that consciously or unconsciously the investigator makes some modification in techniques and that sampling variation is small compared to these biases.) Thus, if the investigator were to seek out the value 6.8 as his critical point because the originator used this value, he might find 35 percent false negatives and 15 percent false positives or any other proportions. On this basis he would conclude the original report has not been verified. What, in fact, he should do is find the critical value giving him, say, 20 percent false positives and then determine the percent of false negatives for this critical point. If this turns out close to 24 percent or less, the evaluation confirms the original report; if it is considerably higher, then the investigator rejects this test based on the way he performed it.

The two essential points in an evaluation program are, therefore:

1. Two sensitivity measures must be compared where each is obtained for a fixed specificity (or the converse).

2. The critical value to be found in determining the sensitivity is itself determined by the given specificity.

Costs of examination and incidence of cancer are such that it was reasoned no screening program for cancer could tolerate more than 10

percent false negatives for at most 5 percent false positives. These criteria need not be followed if one searches for a diagnostic test to be used for other purposes, such as differential diagnosis.

Evaluation of Tests

A considerable number of reports have thus far been published as a result of the cancer diagnostic test evaluation program. A list of these reports, classified according to type of substance being measured, appears as an appendix to the most recent publication, a monographic collection appearing as Evaluation of Cancer Diagnostic Tests, Public Health Monograph No. 12. In addition to tests on which reports have been published, several tests were evaluated by the various groups at the request of the National Cancer Institute and other institutions. These represented tests being developed currently and for which no large-scale evaluation was necessary in order to reject them. On the other hand, several tests announced in the last 5 years were evaluated fully and reports were published.

Unfortunately, as reference to these publications will show, none of the procedures evaluated has been judged capable of discriminating between individuals with cancer and those without cancer to any reasonably high degree. For a cost of 5 percent false positives among presumably normal, healthy individuals, these tests, as evaluated, detected as positive from 10 percent to about 75 percent of known cancer patients, with the majority ranging from 40 percent to 60 percent. For the most part, these tests also found as positive from 25 percent to 50 percent of patients with diseases other than cancer. But more serious from the point of view of screening is the fact that these tests gave rather poor results among known cancer patients with well-established disease. Presumably, if groups of individuals with very early cancer were available, these tests would detect as positive still smaller proportions.

Evaluation and Developmental Findings

Although results have been negative in the search for a general test for cancer, all of the participating groups are continuing in some developmental field of their own. In some cases, investigation is being made into the diagnosis of cancers of specific sites; in others, work is being continued on those general tests which a group thought promising. Every group is doing research into the development of its own procedure, both on the laboratory and clinical level.

All participants have concluded from their evaluations thus far that much has yet to be learned about the relationships to the cancer process of those factors which these tests purport to measure. The awareness and the need of a greater understanding of the effects of this process on the biochemistry of the individual are evident in the report on the Proceedings of the First Conference on Cancer Diagnostic Tests (*3*). The very purpose of this conference, sponsored by the National Cancer Institute, was that ". . . further developmental research in the cancer diagnostic test field should be stimulated."

It would appear that one reason these tests have failed is the lack of specificity in the factors assumed to be changed by cancer. Generally, these factors seem to be affected by many disease processes. In fact, they are found to vary among normal individuals. This raises some interesting questions concerning the concept of a diagnostic test (see paper by Toennies in reference 3). Given that normal individuals really differ with respect to a given factor, does the single individual's test value vary with respect to time or does it remain relatively stable? If it does change with time is this variation random around some true value and, if so, how does it compare with the variation among individuals? If it is relatively small then obviously if an individual's test value begins to increase progressively over time, he should be suspect even if his test values are not above the critical point (assuming cancer values are on the average larger than normal values). However, before such serial testing on an individual basis can be of use, much data must be gathered to answer the above questions on variation.

A start in this direction was made by one laboratory, which was able to obtain more than one blood specimen on normal persons over a

period of a year. We illustrate some of these ideas referring to the evaluation, by this laboratory, of the least coagulable protein test proposed by Huggins (*4*). With respect to this test, the values of 137 normal individuals ranged from 1.10 to 1.91 with a variance, $\sigma^2=0.0139$. The variation among individuals, measured by the variance, can be considered to be made up of three components: variation among true individual values, σ^2_{Ind}, variation between specimens from the same individual when specimens are taken over a period of time, σ^2_{sp}, and variation due to the reproducibility, or measurement error, of the technique, σ^2_m. Estimates of these components were as follows: $\sigma^2_{Ind}=0.0075$, $\sigma^2_{sp}=0.0022$, $\sigma^2_m=0.0035$. Variation due to specimens, σ^2_{sp}, represents about 16 percent of the observed variation among individuals and about 30 percent of the estimated variation of true individual test values. Consider an individual with a true value of 1.3. Assuming no improvement in technique can be accomplished to reduce measurement error, 95 percent of specimens from this person should result in values ranging from

$$1.3-2\sqrt{\sigma^2_{sp}+\sigma^2_m} \text{ to } 1.3+2\sqrt{\sigma^2_{sp}+\sigma^2_m}$$

or 1.15 to 1.45. Now, if this person gets cancer, his true value should begin to increase and hence his test values should eventually fall outside his normal range. When this occurs, his test should be considered positive even though no value is greater than the critical point (in this case, 1.63).

Considerations of this sort have come out of the analysis of the data gathered in the evaluation program. For two other tests, σ^2_{sp} represented a much greater proportion of the total variation. In fact, for one test it was almost 50 percent of the total variation and exactly equal to the estimated variation of true test values. In these instances, no serial testing on an individual basis would be meaningful.

Present and Future Developments

As indicated earlier, the various laboratories that have been engaged in diagnostic test evaluation have continued investigating certain procedures that still appear to hold some promise, and are exploring developmental possibilities that have attracted their interest. The former includes further work with a serum flocculation reaction that has undergone additional development since originally reported; exploration of fluorescence phenomena observed in the blood from cancer patients; polysaccharides of serum that are augmented in cancer patients; and use of several serum protein determinations in combination. Developmental investigations by these groups include investigations into a sensitive means of detecting abnormal steroid in the blood or urine; a complement fixation test; a study of the factor responsible for liver catalase reduction in cancer; and a specific measurement of prostatic acid phosphotase. This last has been developed to the point where several laboratories are evaluating it as a means of diagnosing premetastatic prostatic cancer.

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A Review of Pollenosis And the Role of Weeds

By W. C. Spain, M.D.

THE TERM "WEED" and the term "allergy" not only are difficult to define but are vague, indefinite, elastic, and subject to wide variations in interpretation. An agreement upon the concept of these two expressions is essential to any remarks that may be made upon them.

When does a plant become a weed? What is a weed? One's point of view would have something to do with reaching a decision. The overgrown vegetations of the tropics, rank and commonplace, become rare and pleasing exotic plants elsewhere; the goldenrod, an annoyance to the farmer, may appear as a colorful attractive flower to the urban dweller. It would seem that a plant becomes a weed when its nuisance value outweighs its esthetic or economic worth to man; when its lustiness and vigor, despite its beauty of form or flower, permit it to crowd out more delicate and more desirable plants; or when its noxious qualities make it a threat to the well-being of man and animal. On the basis of their being specific hazards to his own health, the allergic individual is inclined to group as weeds many additional plants which actually are of value in the general economy and are attractive and harmless to the majority of the population, but to him are decidedly disturbing.

The person suffering from an allergic malady is a peculiar individual, due largely to the fact that his symptoms are caused usually by a maladjustment to his physical environment rather than by any bacterial invasion of his body by infection. His ailments result from exposure to commonplace substances with which all persons are equally in contact. Although exposed to these substances to a degree no greater than are other members of the general population, his symptoms are prompt, severe, incapacitating, and place in the role of a major offender with great etiologic importance such an ordinary and usually harmless agent as the ever-present weed.

Dr. Spain is professor of clinical medicine at the Post Graduate Medical School, New York University, and attending physician and director of the division of allergy, medical department, University Hospital. He is a member of the editorial board of the Journal of Allergy. *This paper is condensed from an original lecture given by the author at the weed control conference conducted by the New Jersey State Department of Health at Rutgers University on April 8, 1953.*

Heredity a Factor

This tendency to react with marked discomfort to his surroundings is hereditary. It is a family trait transmissible from a member of one generation to that of another, apparently governed according to the laws of dominance that Gregor Mendel found operative in his study of the transmission of traits of the sweet pea. It is important to remember that the feature which is inherited is the capacity of the allergic individual's tissue cells to become extremely irritated or sensitized in a specific manner. The well-developed clinical allergic complaint itself is not inherited, its form being influenced greatly by the exposures and contacts in the individual's environment. Hay fever, rhinitis, bronchial asthma, bronchitis, and dermatitis (urticaria and eczema) are examples of allergic maladies caused by this cell sensitization. The tendency to an allergic condition may be manifested in a parent as hay fever, in the child as an entirely different ailment such as bronchial asthma.

The Role of Phagocytosis

Nature has provided a clearing mechanism for protecting man from the irritation of foreign substances passing into his system by absorption through the respiratory and gastrointestinal tracts and the skin. These foreign substances, naturally and normally present, are in the air we breathe as are pollens, dusts, animal danders; in the food we eat; in plant resins with which the intact skin comes into contact. Upon being absorbed into the body, such sub-

stances are attacked by tissue cells especially equipped for the purpose of neutralizing and disposing of any invading foreign material.

This process is completed without harm to the normal individual or his tissue cells, and without apparent detrimental after-effects such as the development of allergic symptoms. In 10 percent of the population, however, this special protective mechanism or phagocytosis does not end with this normal activity of disposing of foreign matter. The mechanism, often through hereditary influences, extends beyond this, becoming exaggerated and overcompensating. Enormous increases in the number of the defensive tissue cells or a great enhancement of their protective activities, or both, are stimulated by their contacts with the foreign substances. Such cells are equipped to produce a prompt and vigorous attack upon the reinvading foreign substance. This activity is responsible for the release of toxic materials which cause the severe, often incapacitating allergic symptoms.

Individuals whose tissue cells are thus sensitized to intense activity upon exposure and reexposure to foreign substances are termed allergic, and their symptoms may assume a variety of forms such as those of hay fever, bronchial asthma, or of allergy of the gastrointestinal tract or skin, depending upon the body area in which occurs the greatest degree of sensitized cell activity. Urban dwellers and rural workers, child and adult of all races are affected. The foreign materials, the causative agents, are many and varied, but are usually airborne as pollens, dusts, or ingestible substances such as foods and drugs.

Airborne Pollen

Of major importance are airborne plant pollens drawn into the respiratory tract in the inhaled air. The heavy, sticky type of pollen which tends to be immobile unless transported by the bodies and wings of visiting insects and bees is rarely the cause of hay fever. The colorful, attractive, often scented blossoms such as of the rose, the daisy, or goldenrod, designed to lure these carrying agents, are harmless unless cut and brought indoors where they dry, allowing their pollens to permeate the closely confined atmosphere of the house. The airborne pollens of the plants with inconspicuous, less noticeable blossoms are the usual cause of hay fever. Produced in tremendous excess, buoyant and widespread, these pollens are responsible for the distress of thousands of persons with hay fever and with bronchial asthma.

Not all types of airborne pollen are hay fever and asthma producers. Over the past four decades it has been the goal, seemingly impossible, of allergist and of botanist to discover in all the wealth of vegetation the particular offenders, and to identify the plants whose pollens produce allergic symptoms. In this the investigators were aided by two tremendously important facts; the first, that the skin cells of the allergic patient share the sensitization found in other types of tissue cells; and the second, well known to you, that there has been established by nature a reliable, dependable schedule of pollination characteristic of each plant, a schedule influenced but slightly by climatic or weather variations.

The Skin Test and Pollen Count

The skin test is the great diagnostic aid which enables identification of the patient with hay fever and also determines the specific, exact pollen causes important in his case. Upon exposing the cells of the skin by puncture or scarification procedures to minute carefully estimated amounts of extracts of the various suspected pollens, characteristic changes will occur, but only at those sites tested with the pollens to which the patient's cells are sensitive. Within a few minutes itching, flushing, and swelling of the skin will occur, with the development at the test site of a wheal or small hive, which persists for 15 to 20 minutes, then disappears. This test is very specific and delicate. It enables the investigator not only to identify the particular offending pollens, but also to determine the degree of sensitiveness present in the individual to each specifically offending pollen, a matter of great variability from patient to patient, and from pollen to pollen.

Well known to the patient suffering from a pollen allergy is the period within which his symptoms occur. The seasonal limits of onset

and offset of his discomforts are relatively constant from year to year, provided he continues to be in the same environment. By comparing the period of suffering with the pollination period of various plants producing airborne pollen, the investigator is enabled to narrow the list of possible causes in each patient's problem. The individual with hay fever occurring from mid-August to October is immediately suspected of being a victim of ragweed pollen, since its pollination period coincides with the patient's time of discomfort.

Additional useful information regarding pollen allergy may be obtained by comparing the patient's daily fluctuations in the degree of severity of his symptoms with the daily census of his specifically disturbing pollen as influenced by variations in weather conditions. A daily count of the pollen trapped upon an adhesive coated slide, exposed for constant periods, will provide the information upon the rate of pollen production. Thanks to their characteristic appearance microscopically, a classification can be made of those pollens most prevalent. Ragweed pollen has been made the object of special study. The New York State Department of Health has thus been able to determine areas in the Adirondack Mountains relatively free of this weed, and has prepared a valuable list of these for ragweed sufferers (*1*). New Jersey (*2*) and the city of Detroit (*3*) sponsor active pollen surveys, and according to information supplied by the division of laboratories and research, New York State Department of Health, New Hampshire and Maine also conduct these surveys.

The lists of weeds and plants which cause hay fever are known through the highly successful efforts and zealous cooperation of the botanist. Field studies and pollen surveys, the collection of pollen from suspected plants, and its subsequent testing by the allergist upon pollen victims has yielded an evergrowing mass of information. Throughout the years important data has been collected in all areas of the United States, the Central and South American Republics, England, and other European countries. Two of the most valuable reference volumes upon the hay fever producing plants of the United States are that of Wodehouse (*4*), and Durham (*8*).

Three Seasonal Groups

In the Northeastern area of the United States the dates of pollination of the important hay fever and asthma producing plants permit a sharp division of the pollen victims into three groups. In the first are those whose symptoms occur between mid-March and June first. No weed is a culprit although many tree pollen victims in this group are ready to stigmatize as weeds the real sources of their discomfort, which are the ash, beech, birch, elm, oak, hickory, paper mulberry, and poplar. The pollen of the alder and of the swamp sedges occasionally produces symptoms.

In the second group, the symptoms persist from mid-May to mid-July. English plantain (*Plantago lanceolata*) is a weed of much importance here, with sorrel (*Rumex acetosella*) of lesser importance. Of greater moment than these weeds, however, is the family of grasses—timothy, orchard, oat, rye, redtop, june, bermuda, sweet vernal, velvet. Roses, since insect pollinated, are innocuous unless cut and kept indoors. The term "rose cold" is, therefore, an incorrect designation for the summer type of hay fever.

In the third group of patients the symptoms occur from mid-August to frost, and it is here that the weed asserts its importance. The ragweeds, giant and dwarf (*Ambrosia trifida* and *elatior*), are the chiefs of them all, having the dubious reputation of being the cause of more suffering than all other pollens combined. Not only does the discomfort they produce involve a greater number of victims, but the suffering is more intense in degree and occurs at a time of the year, at the threshold of autumn, when secondary, complicating bronchial and sinus diseases are encouraged to appear. It has been estimated that one-third of all untreated ragweed hay fever sufferers eventually develop bronchial asthma, a much more serious and disabling disease. Of lesser importance than ragweed are cocklebur (*Xanthium*); lambsquarters (*Chenopodium*); pigweed (*Amaranthus*); mugwort (*Artemisia*); American hemp; wild rice (*Zizania*); great reed (*Phragmites*); marsh-elder (*Iva*). Usually goldenrod has on it some adherent ragweed pollen, deposited by wind from adjacent ragweed but, as stated,

goldenrod does not deserve the evil reputation it has. Its pollen, since insect borne, will cause no symptoms unless the blossoms are brought indoors.

The list of weeds which produce allergic discomfort is even greater in other areas of the United States. In the plains States, southwestern States, and the Pacific States, the most troublesome are the chenopods, thistle (*Salsola*), and burning bush (*Kochia*), wormwood and sagebrush (*Artemisia*).

Areas Free of Pollen

Since the distressing allergic symptoms result from actual physical contact of pollen and patient, the surest way for the patient to obtain relief is to escape to an area where the pollen producing plants particularly disturbing to him do not grow. Bermuda, Nova Scotia, the tropics, our own southwest and areas in the Rocky Mountains offer to ragweed sufferers complete freedom from hay fever. Less completely free localities are the southern tip of Florida, California, areas in the heavily wooded sections of the upper Michigan peninsula, of Maine, and of Canada and some parts of the White and of the Adirondack Mountains. The pollen surveys of the New York State Department of Health have established the relative freedom from pollen of numerous Adirondack localities (*1*).

Methods of Destroying the Weeds

Such escapes from pollen, however, are impractical or impossible for the majority of sufferers, who cannot be absent from their work or their families for the long intervals required. For them relief can be expected by attacking the hay fever producing weeds themselves by eradication, a slow, painful, and not very successful process, by manual removal or by cutting at the strategic moment when pollination is imminent.

Far superior are the chemical methods. New York City, according to information from its department of health, and several New Jersey communities conducted in 1946 (*2*) the first centrally directed ragweed control spraying program. By employing a spray of the hormone 2, 4–D, dichlorophenoxyacetic acid, it has been possible greatly to reduce the growth of ragweed within the city limits. In proper dilutions it is reported to be selective in action in that it does not kill desirable grasses, but it is known, of course, to be lethal for vegetables and flowers (*5*, *6*). Persistence in spraying the ragweed areas each year seems essential to prevent a return of the ragweed. Following the example of New York City, other municipalities have adopted this plan of extermination. Until all States in the ragweed zone collaborate in a determined and extensive plan, however, the hay fever victim may be somewhat benefited, but will continue to suffer, since the pollen produced by weeds many miles away can be easily transported to him by air currents.

Individual's Control of Pollen

The patient can conduct a plan of weed pollen control in his immediate environment by the installation in his bedroom or home, and in his place of business, of efficient conditioning units. Such units should filter but not chill the air, since respiratory membranes irritated and congested by pollens seem especially prone to "colds," acute respiratory infections, or sinusitis when suddenly subjected to excessively chilled air. Too, to be most effective, conditioned areas should have as their source of outside air only the conditioning apparatus, and all doors or windows should be kept closed; as little traffic as possible should be permitted into the area, since disturbing quantities of pollen may be imported upon the hair and clothing of those entering.

These measures of escape and avoidance are not altogether successful. Efforts must be made to so condition the pollen sufferer that he may continue to work and live in the pollen-containing atmosphere. This is not the time or place to discuss the therapy of hay fever—but it is pertinent to say that such treatment is based upon an attempt to increase the tolerance of the sensitized cells so that they do not react with such vigor or intensity upon exposure to the disturbing pollen. Minute, gradually increasing amounts of an aqueous extract of the specific pollen excitant are given hypodermically at weekly intervals during the period beginning 3 months before the expected season

and extending through it; or, in selected cases, larger doses administered once monthly throughout the year, though once weekly during the season, are effective (*7*). The use of antihistaminic drugs, of ephedrine, of soothing eye drops, of avoidance of dusts, gases, and chemical fumes contribute to the relief of the patient.

The most important step in the handling of any allergy problem is the attempt to remove the cause. This step can often be readily accomplished by the allergist if the exciting substance, identified by various tests, be an animal dander such as that of the cat or horse, causing asthma; or a food such as egg or chocolate, causing asthma or urticaria. It is impossible to accomplish if the exciting substance cannot be readily removed, being derived from widespread plant sources as in the case of an airborne pollen. Such an exciting cause is effectively reduced only at its point of origin.

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President Names Dr. Keefer Health Adviser to the Secretary

Dr. Chester Scott Keefer of Brookline, Mass., took office August 12, 1953, as special assistant, for health and medical affairs, to the Secretary of Health, Education, and Welfare. His appointment by the President was confirmed by the Senate on July 31.

The position was created in the President's Reorganization Plan No. 1 of 1953 which set up the Department of Health, Education, and Welfare. Dr. Keefer will serve as top staff policy adviser to the Secretary in important external relationships of the Department with national and international bodies concerned with health and medical matters, and will, as needed, coordinate related health and medical programs within the Department.

Dr. Keefer, who received his medical training at Johns Hopkins University, presently is a member of the Executive Committee of the Division of Medical Science of the National Research Council, and chairman of the Council's Committee of Medicine. During World War II he directed United States and Allied procurement of penicillin and streptomycin, and during 1944–46 was medical administrative officer of the Committee on Medical Research of the Office of Scientific Research and Development.

Dr. Keefer has served in key positions at Johns Hopkins Hospital, Billings Hospital at the University of Chicago, and Boston City Hospital, and has served on the faculties of Harvard Medical School and at Peiping Union Medical College. He is director of the Robert Dawson Evans Memorial Hospital. He has arranged to take leave from his position as physician-in-chief at the Massachusetts Memorial Hospital and as Wade Professor of Medicine at the Boston University School of Medicine.

M. Allen Pond, chief of the Division of Engineering Resources, Public Health Service, has been detailed to assist Dr. Keefer.

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Professional Education in Public Health

— *A Survey of Schools of Public Health, 1950* —

By HAROLD S. DIEHL, M.D.

Report on Schools of Public Health in the United States; based on a survey of schools of public health in 1950. By Leonard S. Rosenfeld, Marjorie Gooch, and Oscar H. Levine. Public Health Service Publication No. 276. U. S. Government Printing Office, Washington, D. C., 1953. 110 pages. Price 35 cents.

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SCHOOLS of public health in the United States have been organized in response to demands for personnel trained to perform the various health services which have been developed during the past century. The rapid expansion in both volume and scope of these services at each level of community life has increased the need for persons equipped to apply the accumulated knowledge in the biological and social sciences to the furtherance of community health. There is need for persons who can plan, organize, and administer health services; who can analyze and interpret trends in health conditions; who can identify questions that must be resolved for the improvement of public health activities; and who can conduct the research that provides a sound basis for future developments. Accordingly, several universities have organized schools or departments of public health with varied organization and content of academic and field training. During their relatively short history, these universities have played a dynamic and essential role in public health progress.

Aware of the many complex problems that schools of public health face in their attempts to meet present demands for health personnel and to foresee the qualitative and quantitative demands of the future, the Association of Schools of Public Health asked the Public Health Service to make a study of the schools. The recently published Report on Schools of Public Health in the United States gives in detail the results of that study, describing the organization, staffing, educational programs, students, financial status, and needs of the schools of public health in 1950. This article represents a summarization of the major findings of the report.

Dr. Diehl has been dean of medical sciences at the University of Minnesota since 1935. He received his medical degree there in 1918 and was appointed assistant professor of preventive medicine and public health in 1921, associate professor in 1924, and professor in 1929. Dr. Diehl has been a member since 1950 of the Health Resources Advisory Committee, Office of Defense Mobilization.

Three Major Functions

The report presents data for the nine accredited schools of public health in operation in 1950 at the Universities of California, Michigan, Minnesota, North Carolina, and at Columbia University, Harvard University, the Johns Hopkins University, Tulane University, and Yale University. An accredited school of the University of Toronto and one established at the University of Pittsburgh in 1950 were not included in the study.

An accredited school is one that meets the standards adopted by the American Public

Health Association which set criteria for the institutions, facilities, staffing, and courses, and for the matriculation qualifications of candidates for graduate degrees in public health. These standards, as is appropriate for educational institutions in a rapidly developing field of knowledge, allow the schools wide latitude for experimentation and diversity in their approach to the three major functions which they have in common with other institutions of higher education—instruction, research, and community service.

Instruction

All schools of public health have common goals in their programs of instruction. The first of these goals is to give all students a broad understanding of the principles on which public health practice is based. The second is to train specialists in the various fields of community health services.

As a result of differences in emphasis, departmental organization and course requirements in schools of public health are less highly standardized than in institutions of some other health professions such as medicine and dentistry. All schools of public health require candidates for the degree of master of public health to take at least 2 subjects (biostatistics and epidemiology) in what may be termed the basic public health sciences and at least 2 subjects (public health administration and environmental sanitation) in applied fields of public health. Schools differ, however, in the extent to which they require or offer special training in such subjects as microbiology, nutrition, physiological hygiene, and tropical public health among the basic sciences and in such applied fields as medical economics, maternal and child health, mental health, and industrial hygiene. Thus, some schools train specialists in 1 or more of these applied fields: public health nursing, public health education, public health engineering, or hospital administration. Some schools maintain a full range of separate departments representing the various applied fields of special training; others have fewer departments which may or may not include organized subdivisions for special fields of instruction.

Research

In terms of both faculty time and expenditures, research is a prominent activity of schools of public health. The main fields of research reported by the faculty of the schools were infectious diseases, physiology, biochemistry, and environmental sanitation. The concentration of faculty time and funds on research is higher for schools of public health than for schools of medicine or dentistry.

Community Service

The community services furnished by the faculty of the schools of public health include such activities as continuation and extension courses for people outside the university, participation in consultative services, membership on committees advisory to governmental and voluntary health organizations, and services and

Table 1. Distribution of full-time and part-time faculty by department in 9 schools of public health, 1949-50

Department	Faculty			
	Total	Full-time, in school	Part-time [1]	
			Full-time in university [2]	Other
All departments	484	232	106	146
Basic public health sciences	195	114	36	45
Epidemiology	52	21	9	22
Tropical public health	38	26	5	7
Biostatistics	32	25	3	4
Nutrition, biochemistry	29	18	6	5
Microbiology	22	14	5	3
Physiological hygiene	22	10	8	4
Applied fields	289	118	70	101
Public health administration	86	18	21	47
Environmental sanitation	34	19	9	6
Industrial hygiene	31	15	5	11
Hospital administration	22	5	6	11
Maternal and child health	21	15	2	4
Public health nursing	17	9	4	4
Public health education	16	10	5	1
Medical economics	7	6	----	1
All others	55	21	18	16

[1] Devoting part-time instruction, research, and other activities to the schools of public health.
[2] Full-time faculty of the university.

Table 2. Number of students in 9 schools of public health, 1949–50

Parent university	Name of school	Students [1]			
		Total	Graduate	Undergraduate	Special
Total		1,239	678	395	166
State university:					
California	School of Public Health	240	73	145	22
Michigan	do	180	82	76	22
Minnesota	do	268	101	163	4
North Carolina	do	115	77	11	27
Private university:					
Columbia	do	147	110		37
Harvard	do	90	61		29
Johns Hopkins	School of Hygiene and Public Health	133	113		20
Tulane	Department of Tropical Medicine and Public Health.	14	13		1
Yale	Department of Public Health	52	48		4

[1] Based on data collected from the deans and students.

demonstration projects in community health programs. The schools of public health constitute a national as well as international resource on which public and private agencies draw for advice and assistance in studying health needs and resources and in planning for the development or direction of services to meet changing health requirements.

Faculty

The 9 schools of public health had 484 faculty members in 1949–50, 338 of whom had full-time appointments in the school or in its affiliated university. The distribution of the total and full-time faculty by department (table 1) shows a high concentration in departments of epidemiology and of public health administration.

Faculty members with full-time appointments in the schools were responsible for the major share of the schools' activities, accounting for 70 percent of the total faculty time given to instruction, 82 percent of that devoted to research, and 72 percent of the time spent on community service. The use of full-time faculty from other schools of the university for part-time instruction, research, and other activities of the school of public health is an important means of maintaining a close relationship between the school and the related disciplines of other units of the university. The part-time faculty of the schools of public health represents mainly personnel of State and local health departments or voluntary health agencies whose work in the schools promotes the interrelationship of academic instruction with actual public health practice.

The Student Body

In the academic year 1949–50 some 1,240 students were enrolled in the 9 schools of public health, representing candidates admitted from 51 States and Territories of the United States and from 39 foreign countries. Of the total, more than half were graduate students—those admitted as candidates for master's and doctor's degrees. The others were taking undergraduate work or were enrolled as special students. The distribution of these groups of students among the 9 schools, the concentration of undergraduate students in 4 of the institutions, and the wide range among schools in number of graduate students, from a low of 13 to high of 113, are shown in table 2.

Foreign students represented 17 percent of the graduate students for all schools combined and 25 percent of the special students. These students bring to the schools firsthand knowledge of public health problems in the Latin American countries, in Europe, Asia, and

Africa and assist the faculty in explaining these problems to other students. The training of foreign students, in turn, is a significant contribution by the schools in advancing public health practice in the countries to which the students return and in promoting international understanding. Many of the foreign students who are enrolled as special students are transferred to the status of graduate students when they have overcome language handicaps and have proved their ability to meet the requirements for degree candidates.

The graduate students of the schools of public health enter with prior education and experience in a wide variety of health fields—medicine, dentistry, nursing, veterinary science, engineering, the natural sciences, and the like.

The tabulation below indicates, for all 9 schools combined, 7 fields of study in which 30 or more students were taking majors:

Major	*Number of graduate students*
Public health administration	115
Hospital administration	106
Public health education	86
Environmental sanitation	64
Tropical public health, parasitology	46
Microbiology	33
Epidemiology	30

In this connection, attention should be called to the differences among schools in the emphasis given to special fields of instruction. One-third of all graduate students majoring in public health administration were at Johns Hopkins; nearly half of those majoring in hospital administration were at Columbia University; more than one-third of the group specializing in public health education were at the University of North Carolina, which also accounted for more than one-third of those majoring in environmental sanitation. Johns Hopkins accounted for more than one-third of the graduate students specializing in tropical public health and more than one-half of those with microbiology majors, while all but 8 of those majoring in epidemiology were at Harvard or the University of California. The different schools of public health thus tend to complement each other in providing special instruction, for no one school attempts to provide intensive instruction in the entire range of public health subjects. This division of responsibility represents a sound, economical, and thoroughly desirable development from the standpoint of the Nation as a whole.

High Cost of Training

Public health training is expensive as compared with most other fields of higher education. The relatively small number of students, the high faculty-student ratio needed for individualized instruction, the wide variety of subjects that must be included in the curriculum, and the volume of research and community service performed by the schools all contribute to the high cost of training members of the public health profession.

In addition to the $1.5 million expended by the 9 schools for special research projects for which funds were contributed by Federal agencies, foundations, and industry, the schools spent nearly $3 million for basic operations in 1949–50. Almost 70 percent of the cost of basic operations was for instruction, including departmental research (table 3). The remaining 30 percent of basic operating expense was for such items as plant operation and maintenance, libraries, and administration.

Although there are distinct limitations to the validity of expressing basic operating expense in terms of cost per student, a unit cost figure has some significance in drawing comparisons among professional fields and in providing an index of the Nation's investment in professional education. This study of 9 schools of public health in the United States reveals that the average basic operating cost per graduate student was nearly $4,200 a year, a sum substantially higher than that for training in medical schools or dental schools. Although the cost per graduate student in schools of public health is high in comparison with other fields of instruction, the aggregate annual expenditure for maintaining these schools is nominal when their significance in the national and international progress of public health programs is considered, and in relation to the total expenditures for organized health services.

For the schools of public health as a group, income from tuition and fees constituted only about 14 percent of basic operating expense.

Table 3. Basic operating expense of 9 schools of public health, 1949–50

Expense item	Total		Public control [1]		Private control [2]	
	Amount	Percent	Amount	Percent	Amount	Percent
Total	$2,955,997	100	$1,374,406	100	$1,581,591	100
Instruction	2,034,764	69	968,093	70	1,066,671	67
Administration and general	475,854	16	216,453	16	259,401	16
Plant operation and maintenance	371,677	13	139,742	10	231,935	15
Libraries	73,702	2	50,118	4	23,584	2

[1] 4 State universities. [2] 5 private universities.

Income from endowment represented 20 percent; gifts and grants supplied 25 percent; and the remainder came from State appropriations and transfers of funds from the parent universities.

In line with general patterns of financing higher education, institutions under public control differ greatly from those under private control in source of funds. The group of schools of public health affiliated with universities under private control receive 36 percent of their income for basic operations from endowments while the schools affiliated with State universities received only 1 percent of their operating income from that source (table 4). On the other hand, State appropriations and funds transferred from the parent university provided 71 percent of the income for basic operations for the schools in State universities as compared with 11 percent derived from that source in the schools whose universities were under private control. These findings have significant implications in any analysis of the present financial status and long-range stability and flexibility of resources in the 2 groups of schools.

The basic operating expenses and income as defined in this study exclude the $1.5 million separately budgeted for research projects. Federal research grants and contracts, as would be expected, represented the major source (56 percent) of these special funds in schools of public health in 1949–50. Results of this research as well as of research similarly supported by Federal grants in other schools and universities add greatly to our knowledge and understanding of factors that influence health. They find relatively prompt application in public health practice as one community after another develops or expands its health services in the light of clearer knowledge of health hazards and means of controlling them. The special research projects and the departmental research that is financed as part of the basic operations of the schools of public health not only afford

Table 4. Sources of income for basic operating expense in 9 schools of public health, 1949–50

Source of income	9 schools		Public control [1]		Private control [2]	
	Amount	Percent	Amount	Percent	Amount	Percent
All sources	$2,955,997	100	$1,374,406	100	$1,581,591	100
Tuition and fees	425,052	14	229,410	17	195,642	12
Endowment income	577,390	20	12,028	1	565,362	36
Gifts and grants	742,701	25	149,067	11	593,634	38
State appropriations and university transfers	1,161,736	39	980,273	71	181,463	11
Miscellaneous	49,118	2	3,628	[3]	45,490	3

[1] 4 State universities. [2] 5 private universities. [3] Less than 0.5 percent.

students contact with the methods and objectives of scientific observation and analysis but also enhance their skills in applying the research findings in the work they do when they leave the school.

Needs of the Schools

The serious postwar financial difficulties of institutions of higher learning have been widely recognized. Increasing costs, expanding responsibilities, improving standards, and decline in the share of income available from endowment and private philanthropy are among the factors contributing to these difficulties. The study of schools of public health collected information that provides a quantitative estimate of the unmet needs of these schools.

According to the judgment of the deans and others responsible for the administration of these 9 schools of public health, the schools must have additional full-time faculty and expanded or renovated physical plant and equipment to meet standards of adequacy and to expand their efforts in new fields of desirable public health training. A substantial increase in faculty was considered essential in nearly all schools, representing need for an increase of 25 percent over the available number of full-time faculty in departments of basic public health sciences and of 86 percent in those representing applied fields (table 5). In most schools, the physical plants were considered inadequate, with overcrowded classrooms and laboratories. For all 9 schools combined, it was estimated that nearly $2 million of additional annual income for basic operations was needed, while the aggregate need for construction and equipment was $11.5 million.

Table 5. Departmental requirements for additional full-time faculty in 9 schools of public health, 1949–50

Department	Number additional full-time faculty needed	Percent increase over present full-time faculty
All departments	131	56. 5
Basic public health sciences	29	25. 4
Epidemiology	8	38. 1
Microbiology	5	35. 7
Biostatistics	4	16. 0
Nutrition, biochemistry	4	22. 2
Physiological hygiene	4	40. 0
Tropical public health, parasitology	4	15. 4
Applied fields	102	86. 4
Public health administration	16	88. 9
Maternal and child health	15	100. 0
Industrial hygiene	8	53. 3
Public health nursing	8	88. 9
Environmental sanitation	6	31. 6
Medical economics	6	100. 0
Public health education	5	50. 0
Hospital administration	2	40. 0
All other	36	171. 4

Conclusions

The study summarized here and the companion Public Health Service studies of medical schools (*1*) and schools of dentistry (*2*) are significant contributions to knowledge of the financial and related problems of education for the health professions. This report, moreover, goes farther than the other two, in that it relates the development of schools of public health to trends in community health services and describes the adjustments being made by the schools to gear public health training to new health problems or to those that assume increasing proportions with advances in control of acute communicable diseases. Thus, in accord with the changing spectrum of health hazards, the schools of public health are attempting to expand their instruction and research in the field of chronic illness, mental health, and geriatrics. In response to broadening concepts of the interrelationships of physical and mental health with economic conditions and socioenvironmental factors, an effort is being made to strengthen the resources of the schools in such areas as sociology and economics. In keeping with the widening responsibilities of public and private health agencies, the schools are broadening the content of their educational programs in public health administration, medical care administration, and world health problems.

If they are to continue to set the pace for progress in public health knowledge and prac-

tice, the schools must be able to develop and adjust their programs and resources to changing health concepts, needs, practices, and organization. Dr. Lowell J. Reed, now president of the Johns Hopkins University, writes in his preface to the report:

"Professional education in public health, a relative newcomer in the broad field of education in the health professions, has been characterized by independent thought, active experimentation, and a wide diversity of approach. This experimentation provides a rich fund of experience on which to draw in evaluating the effectiveness of education in public health and in projecting future trends of development. It must continue if education in this field is to retain its place as a vital part of the structure of health services."

A broad public understanding of the origin, development, purposes and significance of the schools of public health in the structure of the Nation's health services, such as can be gained from this report, should greatly assist the schools in meeting the ever-increasing demands being placed on them.

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(*2*) U. S. Public Health Service: Financial status and needs of dental schools. Public Health Service Publication No. 200. Washington, D. C., United States Government Printing Office, 1952. 83 pp.

Assistant Secretary Appointed

Russell Raymond Larmon, specialist in economics and business administration, has been named Assistant Secretary of Health, Education, and Welfare. His appointment was confirmed by the United States Senate July 21, 1953.

A graduate of Dartmouth College, Mr. Larmon served 4 years as executive assistant to the president of Dartmouth, and since 1934 has been a professor at the college in the field of administration.

He has served as a consultant to several business organizations on top management policy and has held board membership in a number of organizations. Mr. Larmon has also served on New Hampshire State commissions and was consultant to the governor on the organization of a State store system, the Department of Welfare, and other matters of State administration. From 1942–44, he was the director of the New Hampshire State Office of Price Administration.

A veteran, Mr. Larmon served with the United States Navy from 1917–18. He is a resident of Hanover, N. H.

The U. S. Public Health Service
Clinical Center

for laboratory and clinical research in medicine and public health

Symbolic as the shape in which it is built—that of the cross of Lorraine—is the role destined for the new Clinical Center of the National Institutes of Health, the research arm of the Public Health Service in the Department of Health, Education, and Welfare. Here those who travel the paths of laboratory and animal research and clinical investigation will meet and intermingle. Clinical evaluation will flow directly and naturally from basic findings. Laboratory assessment will be immediately available for phenomena observed at the bedside. Knowledge and techniques peculiar to dozens of clinical and scientific specialties can be harnessed to a single problem. These are not new concepts nor new attempts, but they are significant in scope and intensity. There is nothing random in the aim of this research institution. The Center exists to increase the pressures on the points which suggest potentially greatest returns toward the goal of making human lives longer and more productive.

These pages provide some descriptive details of this new research resource, supplementing material published in August 1952 (pp. 819–823) and with the frontispiece of the August 1953 issue. Following the general "question and answer" and illustrative material will be found the full dedicatory address of the Secretary of Health, Education, and Welfare and excerpts from remarks of the Surgeon General and the director of the National Institutes of Health.

The Clinical Center of the Public Health Service, Department of Health, Education, and Welfare, is an integral unit of the National Institutes of Health, located in Bethesda, Md., approximately 8 miles from the center of Washington, D. C.

The Clinical Center's construction was authorized in the Public Health Service appropriations act for fiscal year 1948, and its doors opened for admission of study patients July 6, 1953.

Background

Q. How did the concept of a Clinical Center within the Public Health Service arise?

A. The proposal for a "research hospital" where results obtained from laboratory investi-

gations might find clinical evaluation goes back many years. In the 1911 Annual Report of the Public Health Service, for example, the section dealing with the work of the Hygienic Laboratory (later to become the National Institutes of Health) states that "in order to obtain the best results from laboratory research . . . there should be available a hospital to which patients suffering from a particular disease which it is desired to study could be admitted, so that cases could be studied throughout all the stages of the disease."

In 1911 the main need of the Hygienic Laboratory for a hospital was for the pursuit of further information concerning the infectious diseases. But in the years following, proposals for special clinical research facilities were also made for the study of chronic and degenerative diseases, such as cancer, heart disease, mental illness, arthritis, neurological disorders, and dental diseases.

Q. What is the present concept of the Clinical Center?

A. In part, the concept of the Clinical Center today is a logical continuation of the proposals made for such a facility by the Public Health Service in 1911. It is a highly specialized and carefully planned medical research facility serving the seven National Institutes of Health, each of which is allotted laboratory space and, except for the Dental Research Institute, bed space to be managed in terms of the needs of particular research investigations. The physical structure of the Clinical Center, with the close proximity of laboratory and clinical research, answers the present need in medicine to bring the separated scientific and clinical specialties together for a unified attack on disease.

Research

Q. Who determines what disease problems will be studied?

A. Each of the Institutes will select the problems within its field which it wishes to investigate, or two or more Institutes will work out joint research projects on which they will collaborate.

Q. What kinds of problems will be studied in the Clinical Center?

A. In general, studies will be confined almost entirely to those common diseases that are responsible for the greatest mortality and disability among the people of this country. The rare, unusual, or undiagnosed condition will not normally be a subject for study.

Q. What are some representative studies which are projected by the Institutes during the first year of Clinical Center occupancy?

A. Hormone-producing tumors will be carried in tissue culture and their endocrinological activity determined by bio-assay of the tissue culture fluid. The study is aimed at clarifying the striking phenomenon of excessive hormone production in endocrine organs undergoing malignant change.—*National Cancer Institute.*

Metabolic balance studies of patients with chronic rheumatoid arthritis. Objective is to study the effect of changes in mineral metabolism that apparently account for some of the effects of the disease on joints; varying levels of protein, mineral and vitamin uptake; the sex hormones, various adrenocortical hormones, and the growth hormone.—*National Institute of Arthritis and Metabolic Diseases.*

Studies of psychosomatic problems often present in such diseases as asthma and ulcerative colitis. An attempt will be made to determine why some patients react to stress by the development of personality disorders and others by the development of functional disorders.—*National Institute of Mental Health.*

Studies of rheumatic fever. This project involves study of types of streptococci associated with the disease, and measurement of antibodies to various streptococcal types and to various chemical fractions of these organisms.—*National Microbiological Institute.*

Studies on epilepsy will be approached through surgical therapy. In conjunction with such therapy, the physiology of the cortex will be studied through electrocorticographic and electrical localization studies. Such investigations might lead to development of new surgical procedures and to the development of new drugs which influence the basic cause of seizures rather than the symptoms.—*National Institute of Neurological Diseases and Blindness.*

Investigations of high blood pressure. A large number of patients will be studied over a long period to observe the natural history of the condition and to find better therapeutic agents or procedures. The hypertensive patients selected for study will probably remain in the Clinical Center for about 1 month for thorough initial study and then return for 2 or 3 days at monthly intervals for followup observation or treatment. Because of the complexity of the medical problem, a great number of laboratory and special research studies will be required in the evaluation of patients. Blood chemistry studies of the most exhaustive types will be carried out, as will metabolic studies with particular reference to diet and drugs.—*National Heart Institute.*

Studies of the periodontal diseases. These investigations will involve such problems as reattachment of tooth-supporting structures which have become detached or loosened by diseases of the soft tissues of the mouth.—*National Institute of Dental Research.*

Q. What is the relationship between laboratory scientists and clinical investigators in the conduct of research?

A. One of the major goals of the Clinical Center is to bring together in close intellectual and physical proximity virtually all of the clinical and laboratory disciplines. Scientists representing many specialties will be afforded opportunity to exchange ideas and information not only in the course of their studies, but also through casual and informal contacts.

Q. What is the relationship among the various Institutes conducting studies in the Clinical Center?

A. The collaborative nature of much research at the National Institutes of Health will be a significant factor in the overall research program relating to the Clinical Center. Many studies must cut across Institute lines. Hypertension, for example, is not a problem confined to the Heart Institute. It is thought to extend directly into the areas of metabolic and emotional disturbances, and so the study of this entity may involve at least three Institutes. In the Clinical Center, study patients of the seven Institutes will receive patient care services from the Clinical Center central staff. Thus, the patient care facilities of the Clinical Center become a service to be shared in common by the several research programs.

Q. What is the relationship of outside investigators to the Clinical Center?

A. The Public Health Service will provide opportunities for a limited number of established scientists from other research institutions to work in the Clinical Center, usually for a year or less, on problems of their own choosing. They will be furnished space, equipment, technical help, and professional collaboration. Training opportunities will also be made available to young laboratory scientists and to physicians who have finished general internship and 2 years of residency training, thus enabling them to obtain specialized preparation for careers as independent investigators.

Q. What radiation facilities does the Clinical Center provide?

A. To study the diagnostic and therapeutic application of ionizing radiations, the Clinical Center will devote one entire wing, three stories underground and five above, to radiation therapy and research. Special safety features have been incorporated into the design of this wing—shielding, special ventilating and plumbing, and special laboratory equipment and floor surfaces. A unique feature of the radiation wing is the provision of rooms for patients, making possible supervised control of radioisotopes for diagnosis and treatment. Special laboratories in the radiation wing will be used to prepare medications containing radioisotopes, and for their subsequent extraction, purification, and chemical analysis from excretions and tissues.

Q. What can we expect from the Clinical Center research program?

A. The Clinical Center represents an important addition to the Nation's medical resources. It must be remembered, however, that advances in medical science are gradual and represent the cumulative efforts of thousands of scientists and physicians throughout the world. The Clinical Center is a highly developed laboratory.

Its specialized and diversified staff should help bridge the gap between laboratory and clinical research, and between the various special branches of medical science.

Q. Does the Clinical Center train interns and student nurses?

A. No. However, "clinical fellows" who are the equivalent of second- or third-year residents in the ordinary hospital, may qualify for several of the specialties through service in the Clinical Center. Similarly, graduate nurses will receive special training in the care of patients in broad disease categories and in clinical research nursing.

The Research Patient

Q. What are the standards of admission for patients under study at the Clinical Center?

A. Because research is the main function of the National Institutes of Health, the patients admitted to the Clinical Center by a given Institute must meet the terms of investigation as set by that Institute. He must, therefore, *be chosen for admission* as a subject who has those characteristics of a disease or disorder about which National Institutes of Health scientists are asking questions and hope to find the answers. On occasion, a limited number of "healthy" persons will be admitted in order to establish the normal against which the pathological can be measured. No study patient will be admitted unless he is referred through professional channels.

Q. How will it be determined that patients are suitable for study purposes?

A. The Institutes will ask physicians, hospitals, and clinics to refer to them those patients who appear to meet the needs of particular studies. The diagnosis of the patient by his attending physician and further diagnostic checks at the Clinical Center itself will be of paramount importance in determining suitability of patients for Clinical Center admission.

Q. Will patients with rare diseases or diseases which have not been diagnosed qualify for admission?

A. As a general rule—no.

Q. Where will patients be drawn from?

A. It is believed that most patients will be obtained from the eastern seaboard States (*a*) as a matter of convenience to patients, their families, and their doctors, (*b*) in order to facilitate medical followup, and (*c*) in order to reduce the cost of transportation. Under certain circumstances, especially when the condition to be studied is not prevalent in this area, it will be necessary to admit patients from more distant places.

Q. How long will patients remain in the Clinical Center?

A. This will depend on the nature of the study and the condition of the patient. Some studies may require that patients remain under observation for 6 months to a year. Studies of the acute infectious diseases, however, may require a stay of only a few days to a few weeks.

Certain investigations will require that patients remain at the Clinical Center for several weeks of study, then report periodically to the Center on a followup basis for long periods of time. In a limited number of studies, patients will not be admitted to the Clinical Center as bed patients but will report on a regular basis to the research teams for observation and tests.

Q. Are there any special facilities for care of the long-term patient?

A. The Clinical Center has been built with the understanding that hospitalization for prolonged study demands special facilities. Each room will normally have two patients, except when the condition of the patient requires a private room (as in the case of certain psychiatric studies or patients with infectious diseases). The entire building is air-conditioned, and each patient room has a complete bathroom. On each floor is a solarium with comfortable lounges and chairs for patients and their visitors. Indoor and outdoor recreational facilities have been provided, and a library will be available for patients. It is expected that concerts and movies will be presented in the patients' assembly room on the top floor. Protestant, Hebrew, and Catholic services are

to be conducted regularly in the Center's chapel.

Q. Who will be the patient's physician while he is in the Clinical Center?

A. Each patient will have as his physician a qualified clinician from the Public Health Service staff. He will perform the full range of services and assume the responsibilities of the personal physician for the duration of the patient's stay in the Clinical Center.

Q. What is the relationship of the patient's own physician to the patient while in the Clinical Center and afterward?

A. The patient's own physician will be welcomed in the Clinical Center to visit the patient and confer with the staff. Full reports on each patient will be made at suitable intervals to the referring physician or institution. On discharge, the patient is referred back to his physician or institution, or both, and the results of treatment and recommendations for further therapy, if desired, will also be made available. In cases requiring followup observation and therapy, appropriate arrangements will be made with the patient's physician.

Q. Does the Clinical Center have medical facilities available for routine treatment of persons in the local area?

A. No. The Clinical Center operates solely as a research facility. The only exception—as is true of all hospitals and clinics—will be the treatment of emergency cases, such as victims of nearby automobile accidents. Such patients will be transferred to the regular general hospitals of the area as soon as it is safe to do so.

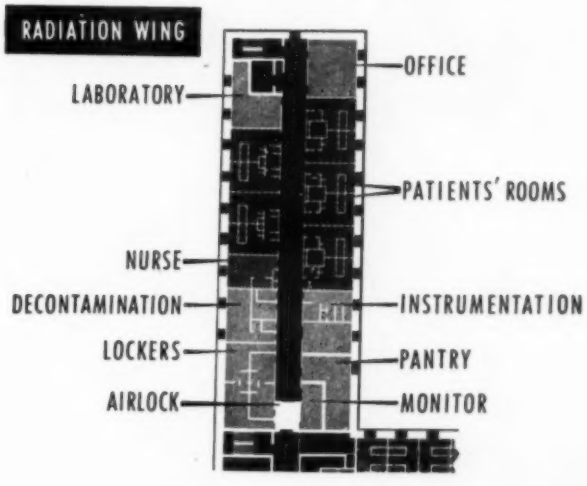
The Clinical Center Structure

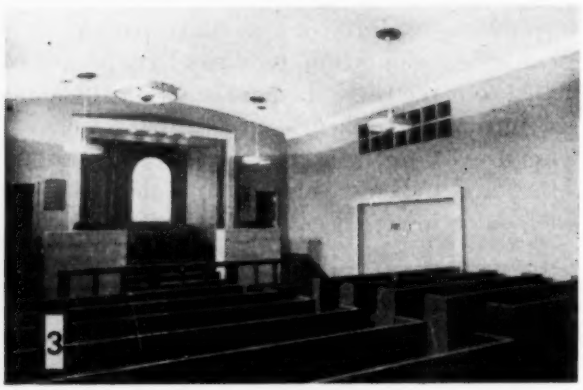
The Clinical Center is designed in the shape of a Lorraine cross in which the central stem of 14 floors is divided lengthwise by 2 corridors. Rooms for patients are located on the south side, separated by a corridor from nursing and related patient services. Clinical research laboratories are along the north corridor. Fundamental research will be conducted in the 6 wings, each of 11 floors. One of these wings (see drawing) is designed especially for radiation studies.

[For schematic floor plans showing the interrelationships between facilities for patients and the clinical and basic laboratory space, see *Public Health Reports*, August 1952, p. 821.]

Patients are cared for in 2 nursing units on each floor, with 13 rooms and a capacity of 26 patients. Typical rooms (see picture 1) are 17 feet long by 11½ feet wide. The nursing station (picture 2) is centrally located in each unit and equipped for economical and efficient service, including voice communication with each patient.

With the welfare of the study patient as a primary consideration, facilities have been provided to make their stay in the Clinical Center as comfortable to them as practicable. A chapel (picture 3) provides regular Protestant, Hebrew, and Catholic services, and clergymen of each faith have offices in the Center. Recrea-



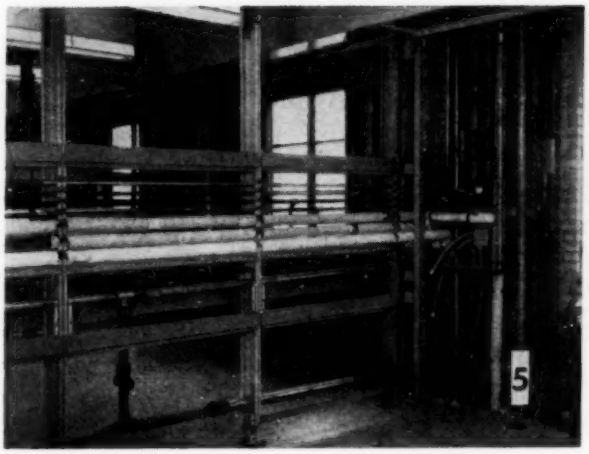


tional facilities are available. Each floor has a solarium for patients which is reached by connecting corridors separate from the laboratory and general public spaces in the building. A

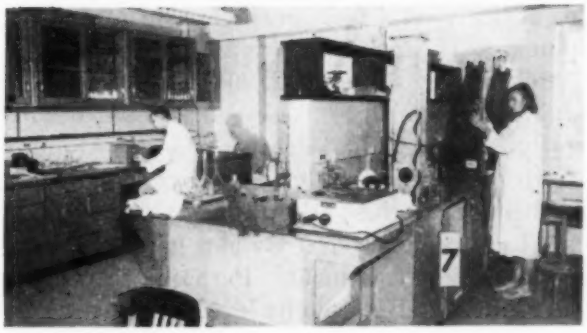
sun deck (picture 4) looks over the rolling hills of Bethesda. Other buildings on the grounds of the National Institutes of Health may be seen, with the National Naval Medical Center in the background.

In addition to 500 beds for study patients, the Clinical Center contains some 1,100 12- by 20-foot modules in the laboratory areas. Flexibility in research space is provided by demountable partitions (picture 5). Laboratory utilities—illuminating gas, vacuum, distilled and hot and cold water—come up the main walls every 12 feet. Plumbing in the partitions brings utilities to the benches and sinks. One of the clinical laboratories, ranged along the north side of the main stem, is shown in picture 6. This is a 2-module unit. Picture 7 shows a 1-module unit in one of the laboratory wings provided for basic investigations.

Several ancillary buildings (picture 8) service the Clinical Center and other units of the National Institutes of Health. Heating, air-conditioning, and a plant for emergency power production are provided in one building. Adjacent are shops, storage, and laundry buildings; incinerator; animal buildings; a grounds maintenance building; and a general utility building. A tunnel permits materials to be transported directly from shops and storage bins to research space in the Clinical Center without the necessity of reloading carts and



trucks. Auxiliary functions are placed in service structures outside the Clinical Center to reduce construction costs and to avoid uneconomical use of research space, as well as to reduce such factors as smoke, traffic, and maintenance activities in the Center itself. An apartment building (containing, for the most part, efficiency apartments, but with a small number of 1- and 2-bedroom units) is still under construction immediately adjacent to the Clinical Center. It will provide housing for medical, nursing, engineering, and maintenance staff whose duties require them to be available for emergency calls.



The Clinical Center building program (which includes, in addition to the Center itself, the various auxiliary structures, land, roadways, storm sewers, and so forth) on completion, fully equipped, will represent a total investment of approximately $64 million. Rough breakdown is as follows: $3.5 million—site acquisition and original plans; $34 million—the Clinical Center building itself; $8 million—laboratory equipment and initial supplies; $17.5 million—fully equipped auxiliary structures (boiler plant, shops, laundry, warehouse, animal facilities, chemical storage, grounds maintenance, isotope laboratory, and general utility building); $1 million—apartments for resident staff performing emergency patient-care duties.

The Clinical Center itself contains 1,266,400 square feet gross, of which 55 percent is net space.

"A Symbol of Our National Concern For the Health of Our People"

Address of Oveta Culp Hobby, Secretary of Health, Education, and Welfare, in dedication of the Public Health Service Clinical Center July 2, 1953, at Bethesda, Md.

It is impossible to stand here today without a feeling of tremendous excitement—the excitement one always feels in the face of an infinite potentiality.

In his book entitled "Death Be Not Proud," John Gunther wrote courageously and beautifully of the gradual death of his son Johnny from a brain tumor. One passage I shall always remember was this: "People may ask if it would not have been better if we had had fewer doctors and less treatment. Perhaps we tried to do too much. But Johnny loved life desperately and we loved him desperately and it was our duty to do absolutely everything and keep him alive as long as possible. Always we thought that, if only we could maintain life somehow, some extraordinary *new* cure might be discovered."

No human being who has ever loved another human being can fail to understand the urgency that hour by hour, minute by minute, the Gunthers felt as they fought off death for their brilliant, endearing son.

The cure did not come in time for Johnny Gunther nor for tens of thousands of others who have the so-called incurable diseases.

New Solutions Ahead

But with the opening of this Center today, we can envision cures as yet unthought of which will bring life to the desperately ill, which in their hour of need will ease the desperation of parents whose children are as yet unborn.

Each new solution to be found here will mean a new chance at the full and finished life for numberless men, women, and children—each one a human being who loves life, each one loved by someone else.

The opening of this Center today in no way minimizes the work of the solitary research scientist working alone. It will aid him and the forces of research scattered across the country.

This Center will provide a focal point for all who inquire—for all who seek sources of life and the causes of death.

This is a practical step, taken by our Government as trustee for the people, toward the threefold goal of improving the health, education, and welfare of our citizens. It will better public health by hastening the conquest of disease; it will widen the bases and the horizons of medical education, and in both these ways it will contribute to the general welfare of the Nation.

A Collaborative Effort

The purpose of the Center—to facilitate and improve medical research—is part of a research program which has gained spectacular impetus since World War II. We are now carrying on in the United States the most intensive and widespread research attack on human disease which the world has ever seen. It is a collaborative effort—a close partnership between the Federal Government and the medical, research, and related professions, universities and medical schools, and numerous nationwide organizations of citizens. Every year the effort widens, as new and old organizations concentrate on specific killers of mankind.

The part played by the Federal Government in this intensive research program is an important one. In fact, half of all research in

medical schools is now financed by the Federal Government. This Department now supports seven research institutes, all of them located at Bethesda. In 1953 Public Health Service grants and related training activities totaled $22.5 million. This investment has contributed dividends to the kind of medical knowledge which, since 1900, has helped to lengthen our national life span by about 20 years and has taught us how to control or eliminate diseases which once were national scourges.

For example, it was a Public Health Service doctor who discovered that pellagra was a dietary deficiency disease, thus leading to its final conquest. Here, in these Federal research institutes, Rocky Mountain spotted fever was identified and a vaccine against it discovered. Here were made early discoveries about Q fever, and here a vaccine against typhus fever was found, a knowledge which has saved the lives of countless numbers of our troops.

Milestone of Progress

The Clinical Center which we are dedicating today is a milestone—a very big milestone, as you can see—on this road of progress. By this joining, under one roof, of hospital, clinic, and research laboratories, the research scientists are acquiring a new and powerful tool in their endless struggle to unlock the stubborn secrets of disease and build a better life for all of us.

The need for uniting clinical studies more closely with laboratory research was first voiced by the Surgeon General of the Public Health Service as long ago as 1911: "The time has now come when in order to obtain the best results from laboratory work there should be available a hospital attached to the laboratories to which patients suffering from a particular disease which it is desired to study could be admitted, so that the cases could be studied throughout all the stages of the disease." He had the vision, but it has taken 42 years for that vision to materialize into this reality.

Initial funds for building this Clinical Center were finally authorized and the first money appropriated in 1947 by the 80th Congress, and you see the result here today. It is not only a symbol of man's untiring search for knowledge and a better life. It is a monument of what can be accomplished when there is unity of purpose and free cooperation toward a worthwhile goal.

For the Clinical Center is in no sense a partisan, politically inspired enterprise. Though funds for its construction were voted by a Republican Congress, the vote was on a nonpartisan basis, with both Republicans and Democrats supporting it.

The late beloved Congressman Frank B. Keefe of Wisconsin was its principal champion in the House, and his success in winning nonpartisan support was shown when the measure passed without a single dissenting vote.

In the Senate, Senators Styles Bridges of New Hampshire and William Knowland of California were among its skillful and successful backers. There, too, it won support from both major parties.

The reason for this nonpartisan approach toward the Clinical Center and toward similar measures to improve the Nation's health is not hard to find. For the Center is an instrument in the unceasing search of science for truth, and scientific truth knows no politics—at least in a free society.

A Unique Structure

As you can see, the building itself is a unique structure. Built in the shape of a Lorraine cross, it is really a set of laboratories wrapped around a 500-bed hospital. No more dramatic revelation of the complexity of modern medicine could be devised than the fact that a structure as large and complicated as this is necessary to bring together all the trained doctors and scientists needed for a full-scale attack on the diseases which are being studied here.

The building has been designed to have the utility and flexibility necessary to meet the ever-changing requirements of laboratory research, patient care, and sound administrative practices.

Patients who come here will have medical care as good as any in the world. The most advanced research techniques will probe into the causes and attempt to find ways of curing and preventing the diseases from which they suffer.

This will be far more than simply another

Federal hospital. All its patients will be referred by medical sources and chosen on the basis of their relation to the disease problems currently under study at the Center. They may remain in the hospital for long periods of time, and after they are discharged, they will be observed closely for periods ranging from a few months to 10 years or more. Their welfare will at all times be the first consideration.

A National Institution

The Clinical Center will be a truly national institution—an invaluable asset which will enrich the resources of our universities and medical schools and a laboratory where scientists from other countries can pursue their studies, thus widening not only their own knowledge but ours. But this Clinical Center's meaning, it seems to me, goes deeper than that. It is a logical outcome of the original concept of this country held by the men who founded it.

These men used powerful phrases to express their concept—phrases which are as strong and vigorous today as when first written a century and three-quarters ago.

From the Declaration of Independence, "We hold these truths to be self-evident, that all men are created equal, that they are endowed by their Creator with certain unalienable Rights, that among these are Life, Liberty and the pursuit of Happiness."

Will not this Center strengthen human hold on life and make easier the pursuit of happiness?

And from the Constitution, "We, the people of the United States, in order to form a more perfect Union, establish justice, insure domestic tranquility, provide for the common defense, promote the general welfare, and secure the blessings of liberty to ourselves and our posterity . . ."

What single institution could be expected to do more for the general welfare or to secure the blessings of liberty to ourselves and our posterity?

This Center is the way responsible government—as trustee for the people—fulfills the obligation placed upon it by the Constitution.

It is new evidence that the United States Government continues to be responsive to the people and to the needs of the people.

I proudly dedicate this Center to medical research as a symbol of our national concern for the health of our people, for their right to pursue happiness unhampered by crippling pain and illness.

In freedom, this building and the people who work here are dedicated to the endless struggle against human suffering.

We are dedicating it today—dedicating it to the open mind of research—dedicating it as an example of democracy heeding its obligation to free men, who, together, are self-governing.

Additional Details

. . . concerning Clinical Center operations and policies will be found in three new publications of the Public Health Service.

The National Institutes of Health Clinical Center

Public Health Service Publication No. 316. 1953. 32 pages; illustrated. 10 cents.

The Clinical Center: Current clinical studies and patient referral procedures

Public Health Service Publication No. 284. 1953. 3-fold leaflet.

Handbook for Patients at the Clinical Center

Public Health Service Publication No. 315. 1953. 16 pages; illustrated.

Publication No. 316 is available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. The other publications may be obtained on direct request to the Public Health Service Clinical Center, Bethesda 14, Md.

"We must press the search for new knowledge . . . use what we know more effectively"

Extracts from remarks of the Surgeon General of the Public Health Service at the dedication of the Clinical Center.

The opening of the Clinical Center symbolizes the hope and faith of the American people that the major killing and crippling diseases of this century ultimately will be conquered.

The very nature of these diseases—subtle reactions of the human organism to its biological inheritance, its total environment—makes it clear that clinical and laboratory research will play an increasingly significant role in medical and public health progress for many years to come.

In a sense, we have reached a period of consolidation of forces for a broad attack on chronic diseases—an attack that can be fully successful only after years of intensive research. This means that we must not only press the search for new knowledge, but we must also use what we do know more intensively, more effectively.

The key to chronic disease control today is early diagnosis and treatment. Hundreds of thousands of the people who will die of cancer or heart disease, or who will be permanently disabled by arthritis or neurological disorders, or mental disease, could be aided if their illnesses were detected in the early stages when present methods of treatment are most successful. The first great promise of medical research is to find new and more efficient ways to early diagnosis and treatment. And the second is ultimately to discover means of positive prevention.

In centering attention on the chronic diseases, we will not forget that our knowledge of infectious diseases—particularly the virus infections—is really quite rudimentary, when measured against what must be known if prevention is to be as successful in the whole range of communicable diseases as it now is in a few. We must not forget the interrelation of many acute infections and chronic disability: the crippling effects of poliomyelitis and encephalitis, for example.

If the Nation's total effort in medical and public health research maintains effective balance and emphasis with respect to all our major problems, the American people can expect advances in human health in the second half of this century as startling as those that have marked the first half.

The Clinical Center will take its place with other major research institutions, private and public, in this long, hard fight.

The Clinical Center, however, is not only a research institution; it is a piece—a large one, it is true—in the kaleidoscope of public health. It is a part of the Public Health Service, and thus a part of the United States Department of Health, Education, and Welfare.

We in the Public Health Service, and our colleagues both inside and outside the Federal Government, have long since recognized the inseparability of science and the society in which it functions. We cannot separate a rheumatic child's illness from his growing mind and body, from his immediate need for schooling, his family's potential need for social service. Nor can we separate the cancer patient's disease from his age, his potential unemployability, or his pension. We cannot separate the crippled workman's paralysis from his chances for rehabilitation and return to gainful employment and happy independence.

The opening of the Clinical Center follows by less than 2 months the establishment of the Department of Health, Education, and Welfare—acts which demonstrate America's nationwide recognition of these relationships. . . .

—Leonard A. Scheele, M. D.

"An atmosphere of excitement, of high expectation and a knowledge . . . of serving mankind"

Extracts from remarks of the director, National Institutes of Health, at the dedication of the Clinical Center.

The United States now has a medical research establishment as fine as any in the world. This building, in its unique and original design, supplies the facilities that are essential for the close interworking of clinical and laboratory research scientists which is required by the intricacies of the search for the cause and treatment of diseases such as heart disease, mental illness, cancer and the other killing, crippling, and chronic diseases with which we will be working. The Clinical Center will make possible research of a very high caliber: our real job now begins.

Medical research is an intellectual pursuit. Its success depends entirely on the capability of the individual. If we are to succeed in this great undertaking, we must continue to attract staff of the highest professional qualifications and continue to maintain an environment in which scientific excellence is the major value. We want to create in this building the atmosphere of excitement, of high expectation and a knowledge of the happiness that can be achieved in serving mankind—the things that are common to all great research institutions.

We want our patients to feel they are our colleagues in research and to experience this same atmosphere. They will receive the best care that medical science can provide. Our moral obligation to do our best to treat the sick is paramount. Clinical studies will go forward within limits set by the welfare of patients. Not only is this a moral imperative—but it is the only way that sound clinical research can be done. These objectives and principles will guide the National Institutes of Health.

In extending our research organization we face the complex problem of establishing the proper relative emphasis upon laboratory and clinical research. We will fail if clinical research overshadows or replaces laboratory work, and we must insure that clinical observations are fully developed in the laboratory.

To those who are not acquainted at first hand with the operation of a research organization these problems may seem abstract. To those who are familiar with the problem I need say no more.

As we today dedicate this building we are merely saying—this is the beginning. We deeply appreciate the faith that the Congress has shown in our assurances that this great investment in medical research will pay off in benefit to the health and welfare of the people of the United States. It will be our job now to make good those assurances. . . .

—William H. Sebrell, Jr., M.D.

Health Department Manpower

In the spring of 1951, the Public Health Service collected information concerning personnel employed and vacancies in positions for professional and technical public health workers in State and local health departments of the continental United States and the Territories. This was done at the request of the Health Resources Advisory Committee of the Office of Defense Mobilization, a committee appointed to consider the availability and use of health resources, including personnel, during the period of defense mobilization. The information obtained was reported to the committee at two of its meetings in the winter of 1951–52, and was the subject of an article by Dr. William P. Shepard, a member of the committee, published in the *Public Health Reports* for August 1952. Final analysis of all data collected and source material for reference purposes have been included in Public Health Monograph No. 13, entitled "Staffing of State and Local Health Departments, 1951."

No later comparable data are available to provide a basis for determining whether the staffing problems of State and local health departments have eased in the past 2 years. From reports on personnel submitted periodically to the Public Health Service by State health departments, the assumption that the personnel situation is still critical appears to be justified. Recruitment of qualified public health workers still lags far behind needs. Established positions that were vacant in the spring of 1951 are, in many instances, still vacant. The "doubling up" of assignments, the discontinuance of programs and services, and the search for candidates for employment continue.

Vacancies in budgeted positions reported by State and local health departments represent only immediate and urgent needs for particular categories of public health personnel. They by no means indicate the extent of total need, even for minimum staffing requirements. To bring existing health department staffs up to the recommended minimum standards would require the services of many more public health workers than the number needed to fill reported vacancies.

Among the personnel employed at the time of the survey, many held status in the various components of the military reserve; many physicians, dentists, and veterinarians had been registered and assigned priorities under

Public Health
MONOGRAPH

No. 13

The accompanying summary discusses the principal findings presented in Public Health Monograph No. 13, published concurrently with this issue of Public Health Reports. The authors are with the Bureau of State Services, Public Health Service.

Readers wishing the data in full may purchase copies of the monograph from the Superintendent of Documents, United States Government Printing Office, Washington 25, D. C. A limited number of free copies are available to official agencies and others directly concerned on specific request to the Public Inquiries Branch of the Public Health Service. Copies will be found also in the libraries of professional schools and the major universities and in selected public libraries.

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Haldeman, Jack C., Cheney, Bess A., and Flook, Evelyn: Staffing of State and local health departments, 1951. Public Health Monograph No. 13 (Public Health Service Publication No. 279). U. S. Government Printing Office, Washington, 1953. Price 30 cents.

the "Doctor Draft Law"; and many more were in the older groups, approaching an age when, even though still actively at work, the services they are able to render must be expected to decline both in quantity and quality. In a national emergency, in which large numbers of trained public health workers would be needed urgently and on short notice, it seems evident that State and local health departments would of necessity be stripped of many of their able-bodied staff members.

For budgeted positions and vacancies, information is available from 1,257 local and 44 State health departments in the United States. For personnel employed in 1951, reports cover 1,470 local and all 48 State health departments. Information is provided for the continental United States as a whole and divided among four broad geographic regions, according to type of department—county, city, local health district, State health district, or other—and according to the population served—in communities of under 35,000 to those of half a million or more. Generally comparable data from the Territories—Alaska, Hawaii, Puerto Rico, and the Virgin Islands—are also included.

Trends in Tuberculosis Mortality In Continental United States

By ALBERT P. ISKRANT, M.A., and EUGENE ROGOT, B.S.

THE NUMBER of deaths and the death rate from tuberculosis continue to decrease very rapidly in the United States. In 1950, there were 33,959 tuberculosis deaths, a decline of 13 percent from the number in 1949. The death rate per 100,000 population for 1950 was 22.5, a decline of 14 percent from the rate for 1949. Further declines were realized in 1951 and in 1952. Estimated figures for 1951 show declines from 1950 of about 13 and 15 percent, respectively, in the number of tuberculosis deaths and in the death rate; similar declines are noted for 1952 in comparison with 1951.

Mr. Iskrant is chief of program analysis in the Division of Chronic Disease and Tuberculosis, Public Health Service. Mr. Rogot is an analytical statistician with the division.

The yearly changes in the number of deaths and in the death rate in the United States for 1933 through 1952 are shown in table 1. (In this table and throughout the report, numbers of deaths for 1940–52 exclude deaths among Armed Forces personnel overseas, and rates are based on population excluding the Armed Forces overseas.) The striking downward trend in the tuberculosis mortality rate was interrupted only once in this period, in 1936. In recent years the rate of decline has accelerated. Since 1945, the tuberculosis mortality rate has been reduced by 60 percent. It is interesting

Table 1. Number of deaths and death rates from tuberculosis (all forms), in continental United States, 1933–52

Calendar year	Number of deaths	Percentage decline from preceding year	Death rate per 100,000 population	Percentage decline from preceding year	Calendar year	Number of deaths	Percentage decline from preceding year	Death rate per 100,000 population	Percentage decline from preceding year
1933	74,842	----------	59.6	----------	1943	57,005	1.2	42.6	1.2
1934	71,609	4.3	56.7	4.9	1944	54,731	4.0	41.3	3.1
1935	70,080	2.1	55.1	2.8	1945	52,916	3.3	40.0	3.1
1936	71,527	[1] 2.1	55.9	[1] 1.5	1946	50,911	3.8	36.4	9.0
1937	69,324	3.1	53.8	3.8	1947	48,064	5.6	33.5	8.0
1938	63,735	8.1	49.1	8.7	1948	43,833	8.8	30.0	10.4
1939	61,609	3.3	47.1	4.1	1949	39,100	[2] 7.1	26.3	[2] 8.7
1940	60,428	1.9	45.8	2.8	1950	33,959	13.1	22.5	14.4
1941	59,251	1.9	44.5	2.8	1951 [3]	29,492	13.2	19.2	14.7
1942	57,690	2.6	43.1	3.1	1952 [4]	25,080	15.0	16.1	16.1

[1] Denotes increase.

[2] Figures adjusted to allow for differences between the fifth and the sixth revisions of the International List of Causes of Death. Provisional comparability ratio (sixth revision : fifth revision) of 0.96 used.

[3] National Office of Vital Statistics: Annual summary, 1951, 10-percent sample of death certificates. Current Mortality Analysis, vol. 9, No. 13, 1952, p. 12.

[4] National Office of Vital Statistics: 10-percent sample for 1952. Monthly Vital Statistics Report, vol. 2, No. 1, 1953, p. 6.

Table 2. Mortality from tuberculosis (all forms), by age, expanding Death Registration States: 5-year intervals, 1900–1935; annually, 1935–50

Calendar year	Number of deaths			Rate per 100,000 population			Percent of deaths		
	Total [1]	Under 45 years	45 years and over	Total [1]	Under 45 years	45 years and over	Total [1]	Under 45 years	45 years and over
1900	38, 820	29, 244	9, 499	194. 4	185. 0	228. 6	100. 0	75. 3	24. 5
1905	39, 168	29, 565	9, 537	179. 9	172. 2	207. 2	100. 0	75. 5	24. 3
1910	73, 028	53, 934	19, 047	153. 8	143. 8	191. 4	100. 0	73. 9	26. 1
1915	86, 726	63, 006	23, 635	140. 1	129. 7	177. 5	100. 0	72. 6	27. 3
1920	97, 366	70, 565	26, 650	113. 1	104. 5	143. 8	100. 0	72. 5	27. 4
1925	86, 510	61, 042	25, 324	84. 8	76. 8	112. 4	100. 0	70. 6	29. 3
1930	83, 352	56, 443	26, 789	71. 1	62. 7	98. 6	100. 0	67. 7	32. 1
1935	70, 080	43, 872	26, 154	55. 1	45. 8	83. 2	100. 0	62. 6	37. 3
1936	71, 527	44, 242	27, 215	55. 9	46. 1	84. 7	100. 0	61. 9	38. 0
1937	69, 324	42, 184	27, 088	53. 8	43. 9	82. 5	100. 0	60. 9	39. 1
1938	63, 735	38, 475	25, 212	49. 1	40. 0	75. 1	100. 0	60. 4	39. 6
1939	61, 609	35, 959	25, 600	47. 1	37. 2	74. 6	100. 0	58. 4	41. 6
1940	60, 428	34, 818	25, 541	45. 8	36. 0	72. 4	100. 0	57. 6	42. 3
1941	59, 251	33, 887	25, 318	44. 5	34. 9	70. 5	100. 0	57. 2	42. 7
1942	57, 690	32, 339	25, 289	43. 1	33. 3	69. 1	100. 0	56. 1	43. 8
1943	57, 005	30, 922	26, 019	42. 6	32. 0	69. 9	100. 0	54. 2	45. 6
1944	54, 731	29, 330	25, 358	41. 3	31. 0	67. 0	100. 0	53. 6	46. 3
1945	52, 916	27, 928	24, 942	40. 1	29. 9	64. 6	100. 0	52. 8	47. 1
1946	50, 911	25, 795	25, 077	36. 4	25. 7	63. 7	100. 0	50. 7	49. 3
1947	48, 064	23, 041	24, 994	33. 5	22. 3	62. 2	100. 0	47. 9	52. 0
1948	43, 833	19, 733	24, 070	30. 0	18. 8	58. 7	100. 0	45. 0	54. 9
1949	39, 100	17, 411	21, 657	26. 3	16. 3	51. 7	100. 0	44. 5	55. 4
1950 [2]	33, 959	14, 170	19, 770	22. 5	13. 1	46. 1	100. 0	41. 7	58. 2

[1] Total includes age not stated.
[2] Rates based on Apr. 1, 1950, enumerated population.

NOTE: The Death Registration States increased from 10 States and the District of Columbia in 1900 to the entire continental United States in 1933.

to note that the period of accelerated decline coincides with the period which witnessed the growth of combined Federal-State antituberculosis programs, intensified X-ray screening activities, and increased emphasis on tuberculosis control generally.

Trend by Age

In 1900, 3 out of every 4 tuberculosis deaths were among persons under 45 years of age. The mortality rate for this age group was 185.0 per 100,000 population, compared to a rate of 228.6

Table 3. Death rates for tuberculosis (all forms), by age, in continental United States, 1900 and 1950

Age (years)	Rate per 100,000 population			Age (years)	Rate per 100,000 population		
	1900 [1]	1950 [2]	Percentage decline		1900 [1]	1950 [2]	Percentage decline
All ages	194. 4	22. 5	88. 4	25–34	294. 3	19. 1	93. 5
				35–44	253. 6	26. 1	89. 7
Under 1	311. 6	8. 5	97. 3	45–54	215. 6	35. 9	83. 3
1–4	101. 8	6. 3	93. 8	55–64	223. 0	47. 7	78. 6
5–14	36. 2	1. 8	95. 0	65–74	256. 1	57. 7	77. 5
15–24	205. 7	11. 3	94. 5	75 and over	269. 2	60. 9	77. 4

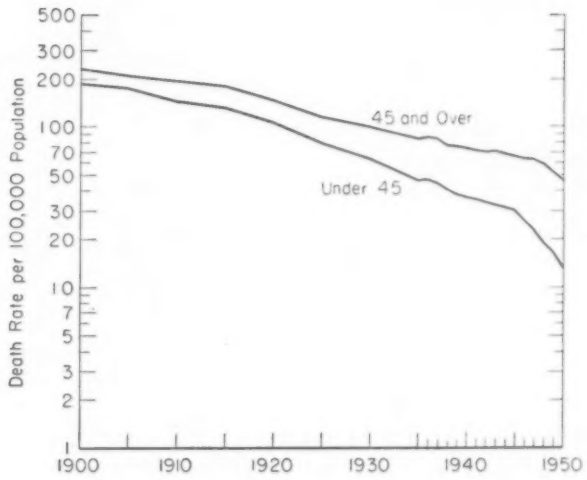
[1] Rates for the Death Registration States: 10 States and the District of Columbia.
[2] Rates based on Apr. 1, 1950, enumerated population.

for age 45 and over. In 1950, only 42 percent of the deaths were among persons under 45 years of age. The death rate for the "under 45" age group was 13.1, compared to a rate of 46.1 for the "45 and over" age group.

The tuberculosis death rates for these two age groups at 5-year intervals from 1900 to 1935 and for each year from 1935 through 1950 are shown in figure 1 and table 2. Both groups showed a remarkable decline in tuberculosis mortality, but with a highly significant difference. The relative difference between the rates for the two groups has been growing at an ever-increasing pace. Tuberculosis mortality has declined more rapidly among younger persons than among older persons and probably will continue to do so.

A comparison of tuberculosis death rates for 10 age groups for 1900 and 1950, shown in table 3, provides evidence that the younger age groups have shown higher percentage declines than the older groups. In fact, with only one exception, each age group has shown a greater percentage decline than the next older age group.

Figure 1. Age trend in tuberculosis death rates, 1900–1950 (expanding Death Registration States).



Trend by Race and Sex

Since 1910, tuberculosis mortality has been reduced dramatically for each race-sex group (figure 2 and table 4). Declines in the death rate between 1910 and 1950 ranged from 84.2

Table 4. Death rates for tuberculosis (all forms), by race and sex, expanding Death Registration States: decennial years, 1910–40; annually, 1940–50

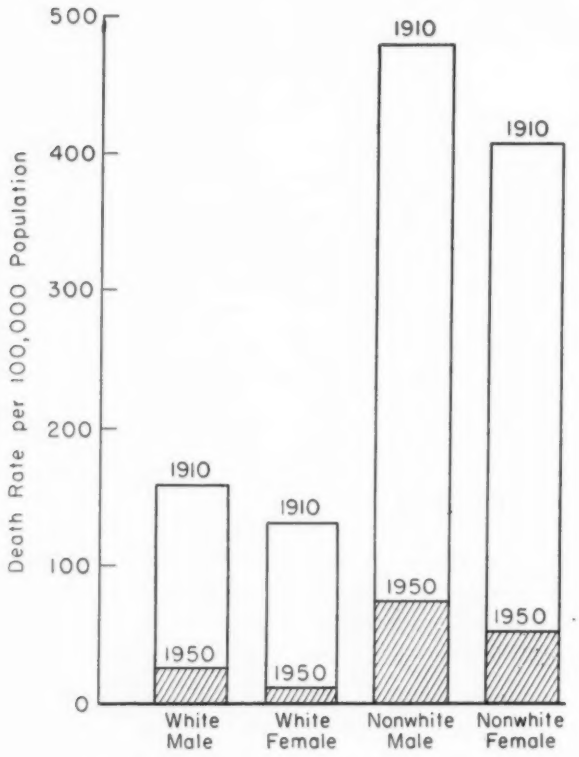
[Rates per 100,000 estimated midyear population in each specified group]

Calendar year	All races			White			Nonwhite		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
1910	153.8	167.1	139.8	145.9	158.2	132.8	445.5	479.3	406.8
1920	113.1	116.6	109.5	99.5	104.1	94.8	262.4	255.4	269.6
1930	71.1	76.2	65.9	57.7	63.4	51.9	192.0	194.3	189.8
1940	45.8	54.1	37.5	36.5	44.7	28.2	127.6	138.7	116.9
1941	44.5	52.5	36.5	35.4	43.3	27.4	124.2	134.3	114.5
1942	43.1	52.3	34.0	34.4	43.3	25.6	118.4	131.4	106.0
1943	42.6	52.9	32.6	34.3	44.4	24.7	112.9	126.4	100.0
1944	41.3	53.1	30.5	33.7	45.0	23.3	106.2	122.7	91.3
1945	40.1	53.0	28.6	32.7	45.1	21.7	102.6	120.9	86.5
1946	36.4	46.2	26.9	29.8	39.2	20.6	92.3	106.2	79.2
1947	33.5	43.0	24.2	27.1	36.3	18.0	88.1	100.6	76.1
1948	30.0	39.4	20.8	24.3	33.3	15.4	78.4	92.1	65.4
1949	26.3	34.6	18.1	20.8	28.6	13.2	72.4	86.7	58.8
1950 [1]	22.5	30.1	15.1	17.9	25.0	10.8	62.3	74.7	50.6
Percentage decline 1910–50	85.4	82.0	89.2	87.7	84.2	91.9	86.0	84.4	87.6
Percentage decline 1910–40	70.2	67.6	73.2	75.0	71.7	78.8	71.4	71.1	71.3
Percentage decline 1940–50	50.9	44.4	59.7	51.0	44.1	61.7	51.2	46.1	56.7

[1] Rates based on Apr. 1, 1950, enumerated population.

NOTE: The Death Registration States increased from 20 States and the District of Columbia in 1910 to the entire continental United States in 1933.

Figure 2. Comparison of tuberculosis death rates for race-sex groups in 1910 (Death Registration States) with 1950 (continental United States).



percent for white males to 91.9 percent for white females. For each race, the rates for females dropped faster than for males. In recent years this sex difference in the mortality decline has become increasingly pronounced.

The characteristic pattern exhibited by tuberculosis mortality for this period has been one of highest mortality in the nonwhite male group, followed in order by the nonwhite female, white male, and white female groups. This pattern has prevailed throughout the period with the exception of two intervals, 1916 and 1919–29, during which the mortality rate for nonwhite females was slightly higher than for nonwhite males.

Current Mortality

Tuberculosis deaths and death rates by age for 1949 through 1951, together with an average for these 3 years, are shown in table 5. As shown by these data, the lowest death rates occur in the younger age groups, and generally the tuberculosis mortality rates increase with age. The tuberculosis mortality level for each age group in 1951 was lower than for the corresponding age group in 1950 and in 1949.

Tuberculosis mortality by race and sex for 1949 through 1951 is presented in table 6. It may be seen here that the rate among males is about twice that among females, and that the rates for nonwhites are more than three times the rates for whites. All groups, however, had lower rates for 1950 than for 1949, and lower rates again for 1951 than for 1950.

Table 5. Mortality from tuberculosis (all forms), by age, in continental United States, 1949–51

Age (years)	Number of deaths				Rate per 100,000 population			
	3-year average	1949	1950	1951 [1]	3-year average [2]	1949	1950 [2]	1951 [1]
All ages	34, 184	39, 100	33, 959	29, 492	22. 7	26. 3	22. 5	19. 2
Under 1	246	279	268	190	7. 8	8. 5	8. 5	5. 6
1–14	1, 137	1, 302	1, 263	845	3. 0	3. 5	3. 4	2. 1
15–24	2, 487	3, 347	2, 497	1, 616	11. 3	15. 0	11. 3	7. 5
25–34	4, 750	5, 712	4, 542	3, 995	20. 0	24. 4	19. 1	16. 9
35–44	5, 715	6, 771	5, 600	4, 773	26. 6	32. 7	26. 1	22. 5
45–54	6, 308	7, 170	6, 227	5, 528	36. 4	41. 6	35. 9	31. 2
55–64	6, 388	7, 067	6, 342	5, 756	48. 0	52. 8	47. 7	41. 5
65–74	4, 809	5, 048	4, 855	4, 525	57. 1	65. 7	57. 7	55. 7
75–84	2, 044	2, 112	2, 071	1, 949	62. 4	67. 5	63. 2	58. 3
85 and over	254	260	275	226	44. 0	56. 4	47. 7	44. 1
Not stated	47	32	19	89				

[1] National Office of Vital Statistics: Annual summary, 1951, 10-percent sample of death certificates. Current Mortality Analysis, vol. 9, No. 13.

[2] Rates based on Apr. 1, 1950, enumerated population.

Table 6. Mortality from tuberculosis (all forms), by race and sex, in continental United States, 1949–51

Sex	Number of deaths				Rate per 100,000 population			
	3-year average	1949	1950	1951 [1]	3-year average [2]	1949	1950 [2]	1951 [1]
Total	34, 184	39, 100	33, 959	29, 492	22. 7	26. 3	22. 5	19. 2
Male	22, 665	25, 538	22, 539	19, 919	30. 3	34. 6	30. 1	26. 3
Female	11, 518	13, 562	11, 420	9, 573	15. 2	18. 1	15. 1	12. 3
White	24, 285	27, 718	24, 136	21, 000	18. 0	20. 8	17. 9	15. 3
Male	16, 803	18, 884	16, 787	14, 739	25. 0	28. 6	25. 0	21. 8
Female	7, 481	8, 834	7, 349	6, 261	11. 0	13. 2	10. 8	9. 0
Nonwhite	9, 899	11, 382	9, 823	8, 492	62. 8	72. 4	62. 3	51. 5
Male	5, 862	6, 654	5, 752	5, 180	76. 1	86. 7	74. 7	64. 6
Female	4, 037	4, 728	4, 071	3, 312	50. 1	58. 8	50. 6	39. 1

[1] National Office of Vital Statistics: Annual summary, 1951, 10-percent sample of death certificates. Current Mortality Analysis, vol. 9, No. 13. [2] Rates based on Apr. 1, 1950, enumerated population.

NOTE: Average numbers of deaths are rounded without being adjusted to group totals.

Table 7. Number of deaths and death rates from tuberculosis (all forms), by age, race, and sex, in continental United States, 1950

Age (years)	Number of deaths								
	All races			White			Nonwhite		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
All ages	33, 959	22, 539	11, 420	24, 136	16, 787	7, 349	9, 823	5, 752	4, 071
Under 5	1, 091	561	530	678	329	349	413	232	181
5–9	221	115	106	126	61	65	95	54	41
10–14	219	83	136	115	55	60	104	28	76
15–19	790	302	488	300	117	183	490	185	305
20–24	1, 707	680	1, 027	765	296	469	942	384	558
25–29	2, 137	974	1, 163	1, 111	511	600	1, 026	463	563
30–34	2, 405	1, 192	1, 213	1, 374	673	701	1, 031	519	512
35–44	5, 600	3, 550	2, 050	3, 682	2, 416	1, 266	1, 918	1, 134	784
45–54	6, 227	4, 820	1, 407	4, 462	3, 561	901	1, 765	1, 259	506
55–64	6, 342	5, 111	1, 231	5, 164	4, 240	924	1, 178	871	307
65–74	4, 855	3, 643	1, 212	4, 213	3, 170	1, 043	642	473	169
75 and over	2, 346	1, 498	848	2, 136	1, 352	784	210	146	64
Not stated	19	10	9	10	6	4	9	4	5
	Rate per 100,000 enumerated population								
All ages	22. 5	30. 1	15. 1	17. 9	25. 0	10. 8	62. 3	74. 7	50. 6
Under 5	6. 7	6. 8	6. 7	4. 8	4. 5	5. 0	20. 9	23. 4	18. 3
5–9	1. 7	1. 7	1. 6	1. 1	1. 0	1. 1	5. 9	6. 8	5. 1
10–14	2. 0	1. 5	2. 5	1. 2	1. 1	1. 3	7. 3	3. 9	10. 7
15–19	7. 4	5. 7	9. 2	3. 2	2. 5	3. 9	38. 1	29. 6	46. 2
20–24	14. 9	12. 1	17. 5	7. 5	5. 9	9. 1	72. 3	63. 6	79. 8
25–29	17. 5	16. 3	18. 5	10. 2	9. 6	10. 8	77. 9	74. 4	81. 0
30–34	20. 9	21. 2	20. 6	13. 3	13. 2	13. 3	88. 8	95. 4	83. 0
35–44	26. 1	33. 5	18. 9	19. 1	25. 4	13. 0	87. 1	107. 1	68. 6
45–54	35. 9	55. 7	16. 2	28. 4	45. 4	11. 5	107. 8	153. 8	61. 8
55–64	47. 7	76. 7	18. 6	41. 8	68. 6	15. 0	124. 5	178. 6	66. 9
65–74	57. 7	89. 9	27. 8	54. 2	84. 8	25. 9	99. 1	149. 2	51. 1
75 and over	60. 9	85. 9	40. 2	59. 2	83. 3	39. 5	84. 6	122. 1	49. 8

A breakdown of tuberculosis mortality by age, race, and sex for 1950 is given in table 7. Important differences may be noted in the ages at which highest mortality occurs in each race-sex category. For white males, the death rates increase almost continuously with age, reaching a high point of about 85 per 100,000 population in the age group 65–74 years. The rate for white females, on the other hand, is fairly uniform from age 20 through age 64, and then rises to a peak at age 75 and over. After age 30, white males generally have higher mortality rates than white females; before age 30, the reverse is true.

Nonwhite males have a higher mortality rate than nonwhite females at ages beyond 30 years. At ages under 30, nonwhite females generally have the higher rates. The pattern for nonwhites is essentially the same as for whites.

The peak age of death is reached between ages 45 and 64 years for nonwhite males and between ages 20 and 34 years for nonwhite females. Both groups show minor peaks for ages under 5 years, then drop to their minimum rates, rise to their major peaks, and finally taper down at the older ages.

Table 8 shows tuberculosis deaths and death rates for 1950 by specified form of disease. The great bulk of the deaths, more than 90 percent, were due to respiratory tuberculosis. Of the 2,866 deaths from nonrespiratory tuberculosis, more than one-third were due to tuberculous meningitis and almost another third to disseminated tuberculosis.

Years of Life Lost

In studying mortality from any disease, it is often useful to obtain some measure which takes into account not only the actual number of deaths from the particular disease but also the age distribution of these deaths. Generally, the younger the age at death, the greater the loss to society. Thus, to fully appreciate the impact of mortality from a given disease, it is necessary to compute a measure which weights each death according to the age at death—the younger the age, the greater the weight assigned to it. This has been done for tuberculosis deaths for 1940 and 1950 (tables 9 and 10).

For 1940, the actual weights used were the

Table 8. Number of deaths and death rates from tuberculosis, by specified form, in continental United States, 1950

Cause of death	Number of deaths	Percent of total	Rate per 100,000 population [1]
Tuberculosis, all forms	33, 959	100. 0	22. 5
Tuberculosis of respiratory system	31, 093	91. 6	20. 6
Respiratory tuberculosis with mention of occupational disease of lung	635	1. 9	0. 4
Pulmonary tuberculosis	29, 228	86. 1	19. 4
Pleural tuberculosis	385	1. 1	0. 3
Primary tuberculosis complex with symptoms	8	(2)	(2)
Tracheobronchial glandular tuberculosis with symptoms	14	(2)	(2)
Other respiratory tuberculosis	34	0. 1	(2)
Tuberculosis, unspecified site	789	2. 3	0. 5
Tuberculosis, other forms	2, 866	8. 4	1. 9
Tuberculosis of meninges and central nervous system	1, 094	3. 2	0. 7
Tuberculosis of intestines, peritoneum, and mesenteric glands	229	0. 7	0. 2
Tuberculosis of bones and joints, active or unspecified	242	0. 7	0. 2
Late effects of tuberculosis of bones and joints	6	(2)	(2)
Tuberculosis of skin and subcutaneous cellular tissue	12	(2)	(2)
Tuberculosis of lymphatic system	67	0. 2	(2)
Tuberculosis of genitourinary system	274	0. 8	0. 2
Tuberculosis of adrenal glands	29	0. 1	(2)
Tuberculosis of other organs	38	0. 1	(2)
Disseminated tuberculosis	875	2. 6	0. 6

[1] Rates based on Apr. 1, 1950, enumerated population.
[2] Less than 0.05.

Table 9. Years of life lost from tuberculosis deaths in continental United States, 1940

Age (years)	White male				White female			
	Tuberculosis eliminated		Number of tuberculosis deaths	Potential years lost	Tuberculosis eliminated		Number of tuberculosis deaths	Potential years lost
	1939–41 $\mathring{e}_x$	Interpolated value			1939–41 $\mathring{e}_x$	Interpolated value		
Under 1	63. 54	64. 64	163	10, 536	67. 90	68. 73	153	10, 516
1–2	65. 73	65. 39	151	9, 874	69. 56	69. 21	158	10, 935
2–3	65. 04	64. 63	79	5, 106	68. 85	68. 42	70	4, 789
3–4	64. 21	63. 77	61	3, 890	67. 99	67. 55	50	3, 378
4–5	63. 33	62. 88	48	3, 018	67. 10	66. 64	42	2, 799
5–9	62. 42	60. 09	140	8, 413	66. 18	63. 82	129	8, 233
10–14	57. 76	55. 41	152	8, 422	61. 45	59. 06	200	11, 812
15–19	53. 06	50. 77	552	28, 025	56. 66	54. 30	1, 022	55, 495
20–24	48. 47	46. 21	1, 260	58, 225	51. 93	49. 58	1, 932	95, 789
25–29	43. 94	41. 67	1, 746	72, 756	47. 23	44. 91	2, 069	92, 919
30–34	39. 40	37. 15	2, 056	76, 380	42. 58	40. 28	1, 773	71, 416
35–39	34. 89	32. 69	2, 222	72, 637	37. 98	35. 73	1, 511	53, 988
40–44	30. 48	28. 36	2, 661	75, 466	33. 47	31. 28	1, 222	38, 224
45–49	26. 24	24. 25	2, 962	71, 829	29. 08	26. 98	1, 031	27, 816
50–54	22. 25	20. 40	3, 133	63, 913	24. 87	22. 86	954	21, 808
55–59	18. 55	16. 88	2, 846	48, 040	20. 85	18. 97	893	16, 940
60–64	15. 20	13. 69	2, 328	31, 870	17. 09	15. 37	862	13, 249
65–69	12. 17	10. 83	1, 768	19, 147	13. 64	12. 10	881	10, 660
70–74	9. 48	8. 34	1, 220	10, 175	10. 55	9. 26	761	7, 047
75–79	7. 20	6. 30	655	4, 127	7. 96	6. 93	519	3, 597
80–84	5. 40	4. 72	272	1, 284	5. 90	5. 13	263	1, 349
85 and over	4. 03	[1] 3. 06	96	294	4. 35	[1] 3. 24	108	350
Not stated			27				10	
Total			26, 598	683, 427			16, 613	563, 109
	Nonwhite male				Nonwhite female			
Under 1	54. 44	56. 38	92	5, 187	57. 60	59. 13	88	5, 203
1–2	58. 31	58. 08	97	5, 634	60. 66	60. 14	74	4, 470
2–3	57. 85	57. 47	45	2, 586	60. 15	59. 76	53	3, 167
3–4	57. 09	56. 67	39	2, 210	59. 37	58. 94	32	1, 886
4–5	56. 24	55. 80	25	1, 395	58. 51	58. 07	23	1, 336
5–9	55. 35	53. 04	107	5, 675	57. 63	55. 30	93	5, 143
10–14	50. 73	48. 42	148	7, 166	52. 96	50. 62	275	13, 921
15–19	46. 11	43. 92	663	29, 119	48. 27	46. 07	1, 138	52, 428
20–24	41. 72	39. 67	1, 100	43, 637	43. 86	41. 74	1, 460	60, 940
25–29	37. 61	35. 63	1, 125	40, 084	39. 61	37. 54	1, 303	48, 915
30–34	33. 64	31. 72	999	31, 688	35. 47	33. 50	947	31, 725
35–39	29. 79	27. 96	956	26, 730	31. 52	29. 67	759	22, 520
40–44	26. 12	24. 41	1, 014	24, 752	27. 82	26. 10	541	14, 120
45–49	22. 69	21. 18	850	18, 003	24. 38	22. 85	379	8, 660
50–54	19. 67	18. 34	670	12, 288	21. 32	19. 99	301	6, 017
55–59	17. 01	15. 82	462	7, 309	18. 65	17. 47	208	3, 634
60–64	14. 62	13. 48	316	4, 260	16. 29	15. 17	135	2, 048
65–69	12. 34	11. 25	230	2, 588	14. 05	12. 97	96	1, 245
70–74	10. 16	9. 16	147	1. 347	11. 88	10. 87	51	554
75–79	8. 16	7. 33	58	425	9. 85	8. 94	24	215
80–84	6. 50	5. 80	24	139	8. 03	7. 22	9	65
85 and over	5. 10	[1] 3. 73	14	52	6. 40	[1] 4. 92	15	74
Not stated			16				16	
Total			9, 197	272, 274			8, 020	288, 286

[1] Value given for $\mathring{e}_x$ at age 90 is used.

life expectancy values taken from a life table from which tuberculosis as a cause of death had been eliminated. The number of deaths for each age group was multiplied by the life expectancy for the particular age group. (The life expectancy was taken at the midpoint of the age interval, since it is assumed that all deaths in a given age group occur at the midpoint.) The product is the number of years of life that the age group could expect to live if tuberculosis had been eliminated as a cause of death. The sum of the products indicates the total potential years of life lost for the entire group.

Table 10. Years of life lost from tuberculosis deaths in continental United States, 1950

Age (years)	White male				White female			
	1950 $\mathring{e}_x$	Interpolated value	Number of deaths	Potential years lost	1950 $\mathring{e}_x$	Interpolated value	Number of deaths	Potential years lost
Under 1	66.6	67.1	72	4,831	72.4	72.8	77	5,606
1–4	67.6	65.8	257	16,911	73.1	71.3	272	19,394
5–9	64.0	61.6	61	3,758	69.5	67.1	65	4,362
10–14	59.2	56.8	55	3,124	64.6	62.2	60	3,732
15–19	54.4	52.1	117	6,096	59.7	57.3	183	10,486
20–24	49.7	47.5	296	14,060	54.9	52.5	469	24,623
25–29	45.2	42.9	511	21,922	50.1	47.8	600	28,680
30–34	40.5	38.2	673	25,709	45.4	43.0	701	30,143
35–39	35.9	33.7	1,030	34,711	40.6	38.3	694	26,580
40–44	31.4	29.3	1,386	40,610	36.0	33.8	572	19,334
45–49	27.1	25.1	1,578	39,608	31.5	29.3	493	14,445
50–54	23.0	21.2	1,983	42,040	27.1	25.0	408	10,200
55–59	19.3	17.6	2,145	37,752	22.9	21.0	445	9,345
60–64	15.9	14.5	2,095	30,378	19.0	17.2	479	8,239
65–69	13.0	11.7	1,888	22,090	15.3	13.7	529	7,247
70–74	10.3	9.2	1,282	11,794	12.0	10.6	514	5,448
75–79	8.0	7.1	821	5,829	9.2	8.1	433	3,507
80–84	6.1	5.3	384	2,035	6.9	6.0	251	1,506
85 and over	4.5	[1] 4.5	147	662	5.1	[1] 5.1	100	510
Not stated			6				4	
Total			16,787	363,920			7,349	233,387
	Nonwhite male				Nonwhite female			
Under 1	59.2	60.3	65	3,920	63.2	64.0	54	3,456
1–4	61.3	59.7	167	9,970	64.8	63.1	127	8,014
5–9	58.0	55.6	54	3,002	61.4	59.1	41	2,423
10–14	53.2	50.9	28	1,425	56.7	54.3	76	4,127
15–19	48.5	46.3	185	8,566	51.9	49.6	305	15,128
20–24	44.0	41.9	384	16,090	47.3	45.1	558	25,166
25–29	39.7	37.6	463	17,409	42.9	40.7	563	22,914
30–34	35.5	33.5	519	17,387	38.5	36.5	512	18,688
35–39	31.5	29.5	533	15,724	34.4	32.4	441	14,288
40–44	27.5	25.7	601	15,446	30.4	28.5	343	9,776
45–49	23.8	22.2	632	14,030	26.6	24.9	262	6,524
50–54	20.5	19.1	627	11,976	23.2	21.7	244	5,295
55–59	17.6	16.4	518	8,495	20.2	19.0	163	3,097
60–64	15.2	14.3	353	5,048	17.7	16.7	144	2 405
65–69	13.3	12.2	297	3,623	15.6	14.3	109	1,559
70–74	11.1	10.2	176	1,795	13.0	12.0	60	720
75–79	9.3	8.7	99	861	11.0	10.3	37	381
80–84	8.0	7.0	32	224	9.5	8.5	14	119
85 and over	6.0	[1] 6.0	15	90	7.4	[1] 7.4	13	96
Not stated			4				5	
Total			5,752	155,081			4,071	144,176

[1] Value given for $\mathring{e}_x$ at age 85 is used.

Table 11. Tuberculosis deaths and potential years of life lost from tuberculosis deaths, by race and sex, in continental United States, 1940 and 1950

	Tuberculosis deaths				Potential years of life lost (in thousands)			
	1950	1940	Numerical decline	Percentage decline	1950	1940	Numerical decline	Percentage decline
Total	33, 959	60, 428	26, 469	43. 8	896	1, 806	910	50. 4
White male	16, 787	26, 598	9, 811	36. 9	364	683	319	46. 7
White female	7, 349	16, 613	9, 264	55. 8	233	563	330	58. 6
Nonwhite male	5, 752	9, 197	3, 445	37. 5	155	272	117	43. 0
Nonwhite female	4, 071	8, 020	3, 949	49. 2	144	288	144	50. 0

For 1950, years of life lost were computed similarly. No life table with tuberculosis eliminated was available for 1950, however. Hence, the potential years of life lost for the 1950 tuberculosis deaths are slightly understated.

As shown in table 11, somewhat less than a million years of life were lost by tuberculosis deaths in 1950. This represents a decline of 910,000 years, or 50.4 percent, from the staggering 1,806,000 years lost as the result of the 1940 tuberculosis deaths. All race-sex groups shared in the general decline, each group showing a substantial reduction during this period.

A comparison of the percentage decline in deaths with the percentage decline in years of life lost shows that each race-sex group had a greater decline in the latter. This is a result of the increasing age at death from tuberculosis, a fact which should be cited as one of the notable achievements in tuberculosis control.

Conclusion

It has been shown in this paper that tuberculosis mortality in the United States is now the lowest in history and that the greatest gains have been achieved in recent years. Moreover, the outlook for the future is encouraging. Tuberculosis, however, ranked seventh as a cause of death in 1950, and was the leading killer from disease for the 15–34 age group. The toll from tuberculosis mortality in terms of potential years of life lost amounted to about 900,000 years in 1950. It is evident from these figures alone that tuberculosis still remains a major killer and still retains its importance as a leading public health problem.

Consolidation of Public Health Service Regional Offices

The Public Health Service offices for Region I (Connecticut, Maine, Massachusetts, Vermont, New Hampshire, Rhode Island) have been consolidated with those for Region II (New York, New Jersey, Delaware, Pennsylvania). Headquarters are at New York City. Dr. Henry A. Holle is regional medical director.

Region IV offices (Kentucky, Michigan, Ohio) have been consolidated with those for Region V (Illinois, Indiana, Wisconsin, Minnesota). Headquarters are at Chicago. Dr. Harald M. Graning is regional director.

Dr. Richard F. Boyd, formerly at Boston, is now regional medical director for Region X, San Francisco. Also transferred to Region X was Dr. Welby W. Bigelow, who had been acting director for Region IV at Cleveland.

technical publications

Reported Incidence of Selected Notifiable Diseases: United States, Each Division and State, 1920–50.

Vital Statistics Special Reports. National Summaries, vol. 37, No. 9, June 15, 1953. 64 pages; tables. Available from the National Office of Vital Statistics, Public Health Service, Washington 25, D. C.

Because of the large number of requests for time series data on notifiable diseases for the country as a whole or for individual States, the National Office of Vital Statistics has issued this special summary report giving the reported incidence of selected notifiable diseases for the United States, each division and State, for the years 1920 through 1950.

A total of 31 diseases of national interest is included in the listing. Since figures were available from comparatively few States prior to 1920, this date was selected arbitrarily as the starting point for the reports of most diseases. A few series are for shorter periods.

The tabulations show not only trends in incidence of disease, but also the changing patterns in classifying and reporting over the years.

The diseases included in the tabulations are: amebiasis, anthrax, bacillary dysentery, botulism, brucellosis, dengue, diphtheria, infectious hepatitis, acute infectious encephalitis, leprosy, leptospirosis, malaria, meningococcal infections, psittacosis and ornithosis, acute poliomyelitis, Q fever, measles, tetanus, rabies in man and in animals, Rocky Mountain spotted fever, scarlet fever and streptococcal sore throat, smallpox, trachoma, trichiniasis, tularemia, tuberculosis, typhoid and paratyphoid fever, endemic typhus, whooping cough, and plague.

for the general public

Coronary Artery Disease

Health Information Series No. 68, Public Health Service Publication No. 145. Revised 1953. 5 cents; $2.25 per 100.

One of a series of four health information leaflets on the diseases of the heart (see *Public Health Reports*, vol. 67, No. 9, p. 928), this recently revised publication is concerned with one of the most common forms of heart disease.

The introductory paragraphs, describing the coronary artery system, are followed by answers to the questions of what is coronary artery disease; what can be done for coronary artery disease; how long can the person with coronary artery disease live; who gets coronary artery disease; and what is now being done to prevent coronary artery disease.

The frequently used terms angina pectoris, coronary thrombosis, and collateral circulation are explained, and the various types of medicine used in the relief of this heart condition, and current research on its cause, are discussed. The reader is advised that under the supervision of a physician, the victim of coronary artery disease has a good chance for a useful life of many years.

Typhoid Fever

Health Information Series, No. 72. Public Health Service Publication No. 282. 1953. 1-fold leaflet. 5 cents; $1.75 per 100.

Although typhoid fever causes relatively few cases of illness or death in the United States, it remains a public health problem in other parts of the world. This health information leaflet describes the disease, its symptoms, how it is transmitted, and present methods of treatment.

Several paragraphs are devoted to the typhoid carrier and the health problems peculiar to this condition. Preventive measures are stressed: vaccination to protect the individual and good public health and home health practices to protect the community. Suggestions are given for travelers, and readers are advised to consult their health officer or physician for further information.

Rheumatic Heart Disease

Health Information Series No. 67, Public Health Service Publication No. 144. 1953. 2-fold leaflet. 5 cents; $2.25 per 100 copies.

The council on rheumatic fever and congenital heart disease of the American Heart Association released, in January, a statement on the prevention of recurrent attacks of rheumatic fever through the prolonged use of sulfonamide or penicillin. (See *Public Health Reports*, January 1953.)

Because of the importance of this prophylactic measure in the control of rheumatic fever and rheumatic heart disease, this health information leaflet has been revised accordingly. In addition to the general information on the nature of rheumatic heart disease and rheumatic fever, diagnosis and treatment, contained in the first edition, the leaflet now includes a paragraph on the advisability of giving children who have had rheumatic fever sulfonamide or penicillin daily, under doctor's directions, for at least 5 years.

Publications for which prices are quoted are for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Orders should be accompanied by cash, check, or money order and should fully identify the publication (including its Public Health Service publication number). Single copies of most Public Health Service publications can be obtained without charge from the Public Inquiries Branch, Public Health Service, Washington 25, D. C.

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